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Phases of Knowledge in Lexical Acquisition:
A Developmental Study into Four to Twelve Year Olds Decipherment of Unfamiliar Words from Linguistic Contexts During Continuous Assessment.

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To Jóhann and Birta

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ABSTRACT

Linguistic Contexts and Verbal Learning in Primary School Children.

Research on the deciphering of nonsense words within the context of text, a story, or tale was conducted at various schools and day-care centres in the Stirling area of Scotland in 1985-1988. Three experiments were conducted, in which large samples of primary school children aged 4-12 were tested. The experiments resembled Werner and Kaplan's (1950) "Word-Context Task," in which isolated sentences in a series with one nonsense word in each sentence were presented to school children. The children were asked to answer questions about the meanings of these words. The results were not in line with the rapid word learning that experience suggests happens in young children, it was not until after age 9 that the children started to give approximately correct answers, and prior to age 11 the answers did not meet up with proper adult definitions. It has been pointed out, however (Donaldson, 1978), that because these sentences were not supported by any relation to immediate context and behaviour, and because the children were required to process utterances as pure isolated language--an unnatural situation for language acquisition, the "Word-Context Task" may have given an unrealistic picture of the child's ability to acquire language naturally.

In the three word-learning studies at Stirling University in 1985-1988, in order to account for a more natural presentation, the sentences with the nonsense word were embodied in the context of a story. Children were thought to fare better (than the children in the Werner & Kaplan study) when listening to such a story, especially if the basic theme was of interest.

A methodological tool, refined in the work of Dockrell (1981), in which the full meaning of a term involves having worked out the sense, reference, and denotation of the term, was applied in each of the test batteries that followed the presentation of the story. In these tests, the children were tested on both their comprehension and production of the new term in question. Drawings were used in order to try to tap the children's denotation of the new term, and to facilitate young children's approach to the demands of the study.

As regards word meaning in general. Martin Joos (1972) had argued that the common blunder was that an odd word must have an odd sense--the odder, the better. He argued that one should define words in such a fashion as to make them contribute least to the total message derivable from its passage where it is housed, rather than, e.g., defining it according to some presumed etymology of semantic history. He called this concept "a tacit principle," and argued that word learners and word users would sense the intuitive familiarity of the conveyed meaning of words and text. Words are, according to this principle, "mysterious" in their environment, their meanings are not worked out deliberately, intentionally; rather, one should make the mysterious item maximally supportive and supported in its situation, in order that redundancy would result in proper connotation of the distributed meaning. Context and knowledge of contexts reveal meaning; the text is processed holistically, and so are the instantaneous meanings of the words of which it is composed.

Thus, Joos maintained that in deciphering an unknown word, the wisest course is to assume the "least meaning" consistent with the context. Tasks such as Werner and Kaplan's "Word-Context Task" (1950), force subjects to infer aspects of meaning that go well beyond this "least" meaning and, as Joos pointed out, this leads notably to errors from which recovery is difficult.

In the studies at Stirling University, attempts were made to determine if different types of learning would result in different types of responses. The dichotomy, intentional/incidental or analytic/holistic was worked out into experimental and control conditions, as based on Aveling's pioneering experiment (1911, 1912) into the general and particular aspects of encoded stimuli. Later, Lee Brooks (1978) worked with the dichotomies intentional/incidental in his Lepton experiments and argued that the more complex a behaviour is (speaking or writing, for example), the more likely it is to be learned implicitly. He pointed out, however, that the dichotomies explicit/implicit, analytic/non analytic, and deliberate vs. intuitive processes need to be elaborated and not taken as a strict division.

In the three experiments at Stirling, children of primary school age (ages 4 to 12) were presented with a "word-context" task and their understanding of the unknown word was probed under different conditions. In the control condition a control word was probed. but in the experimental condition the child's understanding of the target word was fully tested. All the children listened to a short story displayed by a video or read from a tape in which the unknown word occurred in several different contexts, the unknown word in each story denoted an unfamiliar natural kind. During the story's display, children in the control condition were, at certain intervals, asked questions about the story's theme. Children in the experimental group were, at these same intervals, shown a sample of objects, to one of which the unknown word referred, and they were asked to hand these objects to the experimenter as she requested the objects, or they were asked direct questions about the meaning of the target word and about other words in the story. After hearing the story, all subjects were tested on their comprehension and production of the unknown word, together with other words, and a scoring procedure based on a technique developed by Dockrell (1981) was applied. This procedure necessitated the full meaning of the term covering aspects of the sense, reference, and denotation of the new term (cf. Lyons, 1977a).

The results indicate that children younger than those tested in the Werner and Kaplan's "Word-Context Task" (ages 8.6 to 13.6) could decipher the full meaning of the new term. But individual differences within age groups showed greater differences than existed between age groups. All in all, the results indicate that working out the full meaning of a new term is a lengthy process indeed (Campbell & Dockrell, 1986), even though a sense of the given semantic domain may often be established quite early in the learning process. Performance styles also differ from younger children to older ones.

The results indicate that there were significant age differences between the children in the first and second experiments, but that such differences were lacking in the third experiment, and that control subjects in the three studies seldom gave poorer responses than did experimental subjects and often did better. However, the results must be interpreted in the light of learning and recovery from error occurring, within the experimental subjects in the course of deciphering. If the initial scores of the experimental subjects on the target word as obtained during encoding are compared with the first scores obtained from the control subjects after they had heard the whole story, there is a significant difference in scores between the conditions in favour of the control subjects in all age groups. This is consistent with Joos's assumption that an interference concerning the meaning of a word that occurs too early in the learning task and not enough information of contextual cues will lead the children in the experimental groups astray in their guesses when asked too early for answers on the new word's meaning. But implied in Joos's Axiom is the likelihood for recoveries from errors, and the strategies children use in order to work them out need to be explored further.

Much individual variation was found among the children's responses in the age groups. These differences were indeed more significant than were the differences between age groups. Overall, the children did very well at these tasks and that result may be related to the population from which they were selected, Stirling University Playgroup, Psychology Department, Dunblane Primary Schools Nursery and Killin playgroup and primary Schools in Central Scotland.

In general, the study provided support for Joos's idea (1958, 1967, 1972) that early interference with the meaning of a new word when deciphering from a verbal context results in errors. However, recovery is possible, if not guaranteed. The study also indicated that children much younger than Werner and Kaplan's subjects (1950) could work out the full meaning of the unknown word. Earlier studies on context such as theirs may have been biased in using experimental setups with bits of isolated language and thus not tapping the real capability of the young word-learner who may come to learn words and their meanings through contexts, through the procedures that the word is linked to, through the verbal and/or nonverbal circumstance it is used in, and accompanied by actions, and exercised; what John Dewey had termed "context of use" (1910).

Also, it is clear from the study that at a young age children are able to establish a sense of the given semantic domain a new word belongs to and a stable denotata, as their drawings indicate, but in order to decipher the full meaning of a new term is a lengthy process indeed for most children (Carey, 1978a; Campbell & Dockrell, 1986; Miller & Gildea, 1987).

In all age groups and in all conditions there were differences between the children's comprehension and production of the new term in favour of comprehension. However, that result may be related to the nature of the experimental setup (the children gained more experience in working with comprehension than with production), and does not necessarily give support to the claim that comprehension precedes production.

There were differences in the age groups between comprehension and production: children in all conditions gave more correct answers in the comprehension tasks and is in accord with earlier experimental evidence. There were children in all age groups who clearly had acquired the full meaning of the new word, its sense, reference, and denotation, whereas the average picture of the children's performance on all these three aspects was quite scattered. This is in accord with earlier work of Dockrell (1981), which suggests that to work out the full meaning of a new term is a lengthy process, even though a sense of the give semantic domain may often be established quite early. In a posttest, two to three weeks later, in which all the children were tested again on the unknown word, it was clear that learning had indeed taken place and that in most cases children who had mapped the new word's meaning in the first experimental set-up, now felt surer about the unknown word's meaning.

In general, the study provided support for the view that too early interferences and constraints in the learning task lead the young word learner astray, but that children may nevertheless recover from their errors when provided with more information and time. The study also demonstrated that the children were motivated to work at the tasks set before them and that their drawings are a valuable experimental and educational tool for tapping young children's representations.

The results indicated that the control group subjects in all age groups fared better than did the experimental subjects, and age group differences here were, in most cases, significant. That the control group subjects fared better is consistent with Joos's assumption that too early an interference on a word's meaning will lead the children astray in their process of deciphering. However, bombarding the children in the experimental groups with questions on the meaning of the unknown word while they are in the process of encoding hampers the needed reorganisation of the tacit semantic representation underlying their meaning of words.

The different tests that were designed for the three experiments reveal interesting individual variations in the sample and different testing profiles. The tests show much correlation among them, such that tests that were designed in order to test for verbal coding, comprehension, and general knowledge correlate highly and tests that were designed to test for imaginal coding (depicting) show positive correlation to these verbal comprehension tests--high scores on the verbal tests usually relate to good performance in the depicting tests--and tests that were designed for the production of the new word also show positive correlation with tests that only test for comprehension, and, finally, tests of categorisation that were designed to test for linguistic definitions--for conceptual understanding and declarative skill based on the understanding of logical relationships between words in a taxonomy--show some positive correlation to the other tests (such as the ones of production) but less to others. The test results may indicate that the tests of production and the tests of linguistic definitions better reflect semantic content and true linguistic ability than tests of comprehension, general knowledge, and imaginal coding that may be broader and cover more functions and thus reflect general, cognitive knowledge.

These results from the different tests confirm the idea that the meaning of a word has many phases, each of which takes time to grow and to be mastered by the child; the results also show that within the same child and between children there are differences as to their fluency in dealing with these different phases of word meaning and mastering them. Thus, the results confirm the basic notion of this thesis, namely, that different phases are involved in both the composition of a word within text, and in the deciphering of that composition from contextual to acontextual meaning.

CHAPTER 1
INTRODUCTION

1.1 Aims.

This thesis addresses the process of semantic development in children of 4 to 12 years. In particular, there are two emphases: a) the observation of developmental differences in children's acquisition of the meanings of unfamiliar words from linguistic contexts and b) the examination of the effects of experimental interventions on the lexical entries for these new words during continuous assessment.

The development of word meaning is not a simple one-trial affair: rather the process of learning the meanings of words is done slowly by repeated encounters with a word in a number of specific contexts. For children, acquiring the meaning of a new word can be a lengthy process. They may progress through various "wrong theories" of a word's meaning, but they are adaptive and have various linguistic and non-linguistic strategies to map the proper meaning (cf. Campbell & Dockrell, 1986).

The three developmental studies that are described in this thesis are based on the work of Julie Dockrell and Robin N. Campbell at Stirling University. On basis of their data (1981), they have argued that the process of co-ordinating information from various sentences about the meaning of a new word would be accomplished without a child's awareness; thus the precise meaning of a new term would be acquired through a process of semantic reorganisation and with further experience with the word. This process may be hampered, they have argued, if the child is required too early to make a precise guess as to the meaning of the new term.

Martin Joos (1972) has argued that, when deciphering an unknown word, the safest course is to assume the least meaning consistent with the context. This least meaning, though inevitably wrong, includes the correct meaning and converges on it through intersection with least meanings inferred from future encounters with the word. He calls this tacit understanding of words in the context of sentences, Semantic Axiom Number One. Hill (1970) states the same idea in the following: "Meaning is never given by an item which is totally unpredictable. It only occurs when an item is one set of possibilities already defined by the context. In fact, this characterisation of meaning has led me on occasion to define meaning as partial predictability" (p. 252). Similarly, the inferences and predictions in the deciphering of words are based on incidental rather than intentional processing and learning.

The basic aim of the developmental studies outlined in this thesis is to demonstrate a corollary of Joos's Axiom: that children in the process of acquiring a new word should be given time to co-ordinate their meanings and to learn about the subject matter. As can be implied from Joos's Axiom, when the child is required to infer the full meaning of an unfamiliar word, such inferences are inevitably erroneous and recovery from these errors is problematic.

1.2. Joos and Meaning.

In the following, I discuss the main theoretical and empirical notions that the research presented in this thesis is based on.

As the thesis tackles the issue of context, I start with definitions that have been given of that concept. Context can be seen as the interconnected whole that gives meaning to its parts--the sum being different from the parts. Similarly, language can be thought of as a Gestalt, a holistic phenomena of many levels of organisation that are not to be equated with their entering components. Context can be divided into verbal and nonverbal context. Verbal context has suggested itself as an important factor in the process of word-meaning acquisition. The knowledge actually relied upon by children when deciphering new words may be extremely fragmentary and therefore easy for either the child or the observer to miss when the child's explicit knowledge of a new word is assessed. In deciphering the meanings of new words from contextual to acontextual meaning, a process of decontextualization must occur. Light and Butterworth (1992) have pointed out that decontextualization, generally, may arise through the child's construction of mental models. They describe this construction in the following:

> A need for greater understanding is initially aroused by perception of incongruous events, it is developed and supported by dialogue and peer group approval, and it flourishes if mental modelling is unhindered by the immediate need for a definite solution to the problem (1992, p. 10-11).

Thus, when children are in the mental process of modelling their new concepts or creating the meanings of new words out of fragmentary knowledge, explicit questioning could act as an interference effect on their perception and on their progress. The nature of word meaning may be such that it does not lend itself to componential associative specification, therefore, explicit questioning may go against the child's natural sensitivity for the integrity of the perceived language.

In sum, with the nature of word meaning and the relation between language and thought, the question is whether productive insight-thinking and creative representational processes are needed or atomistic, reductive representational processes, or, whether all these processes interact somehow.

Johnson-Laird has suggested (1985) that everyday reasoning is based on types of culturally specific knowledge; that the appropriate context evokes its representation; and that perception presupposes context in deriving meaning from experience. Reasoning has been defined as the ability to call upon, in regularly occurring settings, an appropriate scheme, or context-sensitive rule that has been derived from experience (Light & Butterworth, 1992). Light and Butterworth further argue that the ecological framework for cognition and the role of perception may have been underestimated in the cognitive functioning underlying children's language acquisition, and that when perception is construed as an aspect of cognition, this position will contribute towards a new understanding of thinking as "situated in the world." Hence, if language perception is blurred erroneous cognition may result by which the child's function and adaptation in the world can become affected.

In order to learn a word, the child must be able to associate its sound with its meaning. There are separate learning processes underlying this association: the child must master the mechanics of uttering the word and recognise the word and s/he must master the concept that the word expresses. Even if the child knows that an object has a peculiar name, s/he may need many repetitions before the sound of the new word becomes familiar. Miller (1978) has argued that when a word appears in a sentence, subjects have access to definitional (meaning) information about the word and to contextual (selectional-restriction) information associated with the word. Two stages have been detected in the child's appreciation of the meaning of a word: a rapid stage and a slower, lengthier one. Children are quick to notice new words and to assign them to broad semantic categories--to the proper semantic field. They can keep such fields separate even prior to knowing what the individual words mean but for them to work out the logical discriminations for the word within a taxonomic framework takes much longer (Miller & Gildea, 1987) (see Fig. 1.1, p. 9).

The Canadian linguist, Martin Joos, has advanced the idea (1972) that words are understood tacitly as they appear in sentences; thus every hearer assumes that sentences are to be interpreted in accord with maximum rather than minimum congruence with their environment. This idea implies that in situations where the meaning of the context is known, that meaning is best which contributes least or changes least the total context. Joos has called this tacit understanding of words in sentences Semantic Axiom Number One and states it as follows: "It is the rule that the best guess is that one which maximises the redundancy of word and environment together" (p. 257).

Joos terms the relationship between verbal and nonverbal contexts, or between linguistic patterning and extralinguistic patterning, correspondence meaning. He maintains that correspondence meaning can be deciphered from "other" meanings only conceptually, and then only briefly, for as soon as one tries to employ the distinction it vanishes (cf. Hill, 1970). He says that he did not invent correspondence meaning himself but deciphered it from successful work published during several centuries and from the work of pioneers in child psychology, such as the Sterns. Joos maintains that the common blunder is that an odd word must have an odd sense--the odder, the better. Instead, he argues, one should define words in such a fashion as to make them contribute least to the total message derivable from the passage where it is inserted so that the mysterious item is made maximally supportive and supported in its situation. Then, he maintains, redundancy would bring forth the proper result.

Joos's main impetus for the formulation of the Axiom came as he worked as a lexicographer and a teacher composing text footnotes and glossaries for readers of Middle High German poetry. The main text that he was translating came from the Arthurian Romance, " Parzival," by Wolfram von Eschenbach. In this long poem, there were 19 lines (verses 46 to 49) and one word, especially, the meaning of which Joos and his co-worker, Whitesell were constantly trying, in vain, to decipher. Many lexicographers before them also had been unsuccessful. The lines were as follows:

> "... all red at the hero's desire
> was his sword reddened
> towards the edge/sharpness
> however gelaetet"

(Joos, 1972, p. 258).

It was their long-term confusion over the word gelaetet that Joos has described. After some years of struggle with the word and the context of the poem, a solution as to the word's meaning suddenly emerged:

> "all red at the hero's desire
> was his sword reddened,
> towards the edge however leadened"
>
> (Joos, 1972, p. 262)

"Leadened" for "Gelaetet;" that is, just barely showing a border of bluish grey bare metal or hardened (Hatto, 1980). Joos (1972) pointed out that personal experience and background knowledge were important factors in deciphering. A person must profit from other personal experiences sufficiently to guess the meanings of unfamiliar words correctly, to see that the least meaning of a new word is identical with the meaning of another word in a similar context or environment.

Joos argues that the audience of the poem, in the age when it was written and recited, knew and were more familiar with the situational context to which the fictitious poem referred. According to him, this familiarity was bound to have helped them to decipher the appropriate meaning of the word by using their subconscious, tacit knowledge as they listened to the text. This process would have been so swift that it could only have happened subconsciously. Joos states that in their search for the word's meaning, he and his co-worker underwent the same discovery procedure of learning new materials as do children--namely that of testing the theory to find the best fit, a process that takes place without awareness. He further maintains that there develops in that process a matrix of both conscious and unaware knowledge and that very often, out of the unconscious moiety of that matrix, the answer, solution, or meaning, emerges unpredictably and unscheduled. To this Joos adds:

> Now let me muster the useful matrix elements that I can retrieve and consciously display, presumably not all of them: we never know how much we know after all (p. 260).

In his work. "The Five Clocks," Joos describes his ideas about the different styles of English. His general idea about a reader's processing of linguistic information is that very often the process is automatic and based on some unaware familiarity. Readers will subconsciously feel what a given text means and their intuition will guide them in the deciphering (Joos, 1967, p. 72-75). Joos argued that English is a code and that trying to work the code consciously and logically instead of "listening to what clearly responsible people actually say" is bound to result in error. He spoke of linguistic adjustments as basic complex ways in which speakers adjust their language to the various contexts in which they employ their language. He further maintained that the perceived acoustic input was interpreted by hearers unconsciously and very rapidly with reference not only to the phonological structure but to more abstract levels of grammatical categorisation.

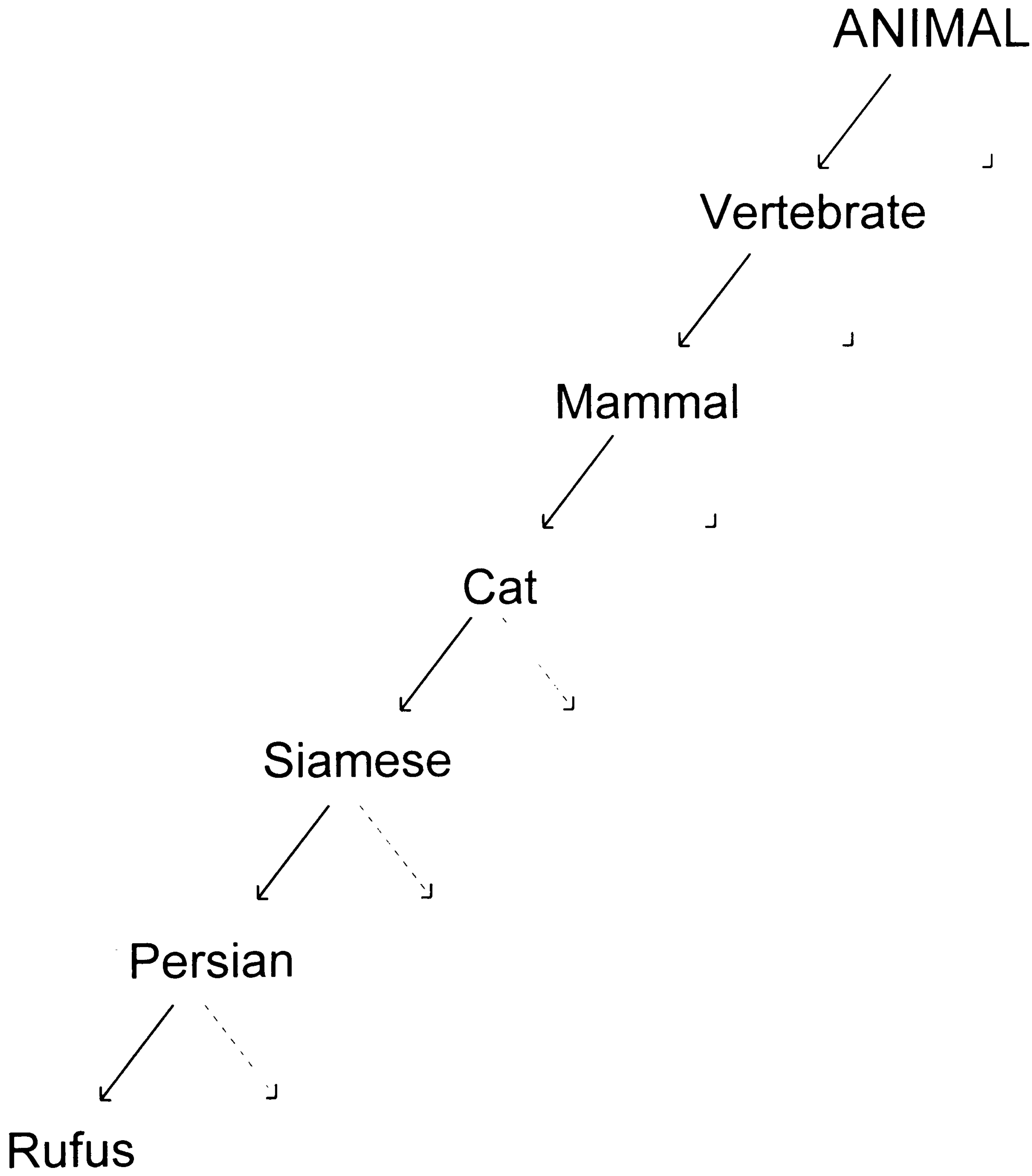
The American linguist, J. P. Denny (1978), later echoed similar views when speaking of "economy of effort." He distinguishes between what he calls "our thought capabilities," (the concepts we are able to form if necessary) and "our thinking habits." The linguistic channelling of thought arises like this:

> To understand the importance of economy of effort we must remember that people use language as an automatic, unconscious tool to facilitate information-processing in the course of other tasks which are subject of their conscious attention and effort. They will resist the need to think about how to express an idea in their language and will settle for those ideas which are easily included in the semantic representation of that language (p. 77).

Joos (1958, 1967, 1972) has argued that in deciphering an unknown word, the wisest course is to assume the "least meaning" consistent with the context. Tasks such as Werner and Kaplan's "Word-Context Task" (1950) (see Ch.1, p. 10-11) force subjects to infer aspects of meaning that go well beyond this least meaning, leading, as Joos has indicated, to errors from which recovery is difficult. The needed tacit processes of understanding are suppressed by the demands for explicit strategies for understanding in their task. It is implied in Joos's assumption that an interference occurring too early or a lack of information about contextual clues will lead a child's guesses astray, particularly if the child is asked too soon for definitions of the new word. The strategies children use in order to eliminate errors need to be explored further. Recovery is possible, if not guaranteed. Joos's thesis also *seems to imply* that implicit knowledge of a word's meaning is acquired in the absence of conscious reflective strategies and that this process, which does not usually take place via deliberate efforts, must be taken into account. To summarise, then, two main implications of Joos's Axiom can be stated: a) the processing of linguistic information takes place implicitly and b) in normal circumstances, we do not most of the time make a deliberate effort to consciously reflect on the processing in such a way as to learn by intent. The main theoretical tenet suggests that deciphering involves a change in the mental representation of the word meaning problem, a change that lives on with the person. Thus, the solving of meaning depends upon both perception and restructuring involving insight thinking as the word meaning problem is suddenly solved in the absence of outward changes, and in the absence of overt trial- and-error approaches. Out of the unconscious moiety of the matrix of conscious and unaware knowledge the meaning emerges unpredictably and unscheduled, i.e. incidentally.

Figure 1.1.

Hierarchical Structuring of Lexicon for Nominal Semantic Field, ANIMAL



1.3. Experimental Evidence.

In the following section, I have given an overview of the literature on the deciphering of unfamiliar words from linguistic contexts, with or without a non-linguistic support. By doing so, I consider experimental evidence that has a bearing to my experimental work to be described in this thesis.

1.3.1. Studies of the Deciphering of Unfamiliar Words from Linguistic Contexts.

I now review the work of the first known researchers on children learning unfamiliar words from sentential contexts: Werner and Kaplan's (1950) work with children.

The Study of Werner and Kaplan (1950).

In their Word-Context Test (1950), Werner and Kaplan tried to determine the ways in which 112 children aged 8.6 to 13.6 could grasp the meaning of an artificial word in a verbal context that replaced an English noun or verb in 12 six-sentence series (such as: "A corplum may be used for support;" "A wet corplum does not burn"). The task was presented, one sentence at a time in written form and with a question about an unfamiliar word within the sentence being answered by the child before a new sentence was given. Each sentence provided further information about the new word. They presented children with six exposures to each new word (all nominals) in a wholly verbal sentential context of six different sentences. The task itself dealt in synonyms. Thus, children were required to find a new word within the sentences to denote a known concept and a known word. The task was so constructed that Werner and Kaplan took English words like the noun "stick" and replaced it by the nonsense word "corplum" to create several sentences using the word "stick" ("corplum") in each sentence. The task was designed so as to observe changes of meaning that took place when a word was to be applied successively to a number of contexts. Each concept was required to be of sufficient flexibility to be applied to a variety of contexts.

Werner and Kaplan were not concerned with correctness of meaning in the responses they received from the children. However, correctness was found to increase significantly from one age level to the next. Their main aim was to observe the processes of signification in the word meanings given by their subjects. Many responses of the younger children indicated a lack of differentiation between the meaning of the word and the given verbal context. Instead of conceiving of the word as referring to a circumscribed meaning, many of the younger children regarded the artificial word as carrying the meaning of the whole or part of the context in which it appeared. There were two groups of immature signification found: in one group, the sentence-contextual group the word carried with it the whole or parts of the sentence context (*sentence-word fusion)*; in a second group, the non-sentence contextual group, the word was clearly differentiated from the sentence context, but still possessed a broad contextual meaning (*holophrastic conceptualisation*). Thus, there was a lack of differentiation between word and sentence in the responses of the young subjects.

The children did not respond correctly prior to age eleven. Before eleven, they could not isolate or integrate the word successfully. Signification based on *sentence-word fusion* decreased most sharply between age levels 9 1/2 to 10 1/2 and 10 1/2 to 11 1/2 whereas signification based on *holophrastic conceptualisation* showed a different developmental trend--it gradually decreased and even at the oldest age level, the 13-year level there were subjects who still showed such solutions.

Recently Miller and Gildea (1987) have modified Werner and Kaplan's study by examining the abilities of elementary school children to acquire new words. Earlier, several other researchers had adapted the Werner and Kaplan technique for children in order to investigate their abilities to decipher word meanings from verbal contexts (cf. Braun-Lamesch, 1972, 1973; Campbell & Bowe, 1978; Dockrell, 1981, and van Daalen & Elshout, 1981 with adults). I will refer to these studies later in this thesis as I describe my own studies.

1.3.2. Studies of the Deciphering of Unfamiliar Words from Linguistic Contexts With Non-Linguistic Supports.

In the following section, I give a description of four studies that have been conducted into children's abilities to decipher unfamiliar words from linguistic contexts with non-linguistic supports. These are the studies of Roger Brown (1957), of Wykes and Johnson-Laird (1977), of Carey and Bartlett (1978a), and of Dockrell and Campbell (1981).

The Study of Roger Brown (1957) and the Studies of Wykes and Johnson-Laird (1977).

Roger Brown (1957) conducted a research on the extent to which young children appreciate the syntactic and semantic rules governing language, in order to learn how children determine semantic properties on the basis of syntactic cues to parts-of-speech membership, and to discover if they use the structural syntactic cues for guessing the semantic referent of form classes. In this context "part of speech" means the grammatical practice of allocating words to one or another sentential category which we think of in semantic terms, such as nouns being conceptualised as naming substances, verbs as naming actions. Brown argued that the children in his study were using structural syntactic cues for guessing the semantic referent of form classes and that the four-year-olds easily identified the object by means of the form-class cue.

Brown maintained that the semantic distinction between parts of speech is much clearer for the child than for adults. Children in this study were able to use such syntactic information and with both the prototypical examples of noun denotata (concrete objects) and verb denotata (actions) were very successful. The children could clearly differentiate among nonsense words (nonsense verbs) referring to movement, particular objects and extended substance (mass noun). Brown's stimuli were pictures of strange shapes, each containing an action, object, and extended surface, so that there was no greater salience of one stimulus than another.

Presenting pictorial test stimuli and pictorial response stimuli allowed the children in Brown's study to establish a "universe of discourse" by creating a framework for the referential act, which is appropriate. His study also showed that such a method could be used successfully with children of three to five years of age.

Wykes and Johnson-Laird (1977) tested 3 to 4 year old children's acquisition of verbs using a story format with a supporting non-linguistic context. The experimenter told a story (four different stories) to one child at a time (fifteen children participated) and acted the story out with puppets (examples from one such story are: "John stepped out of the boat and the water mibbed his trousers so he went home to change into some dry clothes. The water had mibbed his trousers right through so Simon made him some hot tea. But John dropped his cup and the tea mibbed over the floor," (p. 326). The child heard each story four times, on two occasions the experimenter read it and acted it out, and on two occasions the child then attempted to do the same. And, with somewhat older children the experimenters first allowed them to hear the story a few times, and, then, only tested the children on the novel terms metalinguistically; in this case there was no acting out earlier in the procedure.

Wykes and Johnson-Laird argued that "the subjects and objects occurring with a verb might help the child to infer its meaning," (1977, p. 326). In their studies, however, the child may only have associated the occurrence of the object used with the presentation of the novel verb and learnt nothing more about the nature of the verb. Although focusing on the objects occurring with the verb is informative and may have led the child to make a correct response, Dockrell's design (1981), in which the subjects and objects occurring with the verbs were not highly constrained and the children were presented with a choice of responses, may tap their knowledge better, as children can easily be misled by the context in which the verb occurs (see Ch.1, p. 33-34). This situation will force the child to lean more on available semantic categories than on learning simple associations.

However, the important point to learn from the Wykes and Johnson-Laird's study is the fact that they did read each story twice and acted it out to the children and gave them second trials in the testing session following the story-reading, if the children were hesitant. This procedure may have created a pattern of interaction between child and adult and strengthened confidence in the child that was needed for the restructuring of his/her acquisition in the situation. Wykes and Johnson-Laird's results should be estimated in this light.

In summary, one can state that the verbal context and its nature is important even if there is no evidence from earlier studies that the child can pick up the meanings of words more readily in a story format than in a sentence-series context. The child may pay attention to different aspects of discourse in two situations: a) in a story presentation the child may be deterred from focusing on the individual lexical items by attending more to the theme running through the story; b) or, being more familiar with a story format may help the child respond appropriately. The sentence presentation, on the other hand, is not as natural to the child and may lead to local identification of the involved linguistic elements without proper consideration of the total context. In Wykes and Johnson Laird's study, the child was provided with non-linguistic information in the form of acting out, which may have accounted for differences in their result sets and those of Werner and Kaplan (1950).

The Study of Carey and Bartlett (1978a).

Carey and Bartlett (1978a) provided a novel experimental technique that combined both longitudinal and cross-sectional methods in their examination of the acquisition of unfamiliar terms by pre-school children. They studied the course of development of a single colour term in the lexicon of 14 three-to-four-year-olds, by using the unfamiliar word "chromium" to denote "olive green." They plotted the development of the new term over a period of six months. First, they established that a group of three-year-olds did not know the colour olive. Most of the children called it green; some called it brown. They took two cafeteria trays and painted one tray olive and the other blue. Each child was then told casually: "Hand me the chromium tray. Not the blue one, the chromium one." The child would pause and perhaps point to the olive tray: "This one?" "Yes, that one. Thank you."

A week later, with no further guidance, the children were asked again to name the colours. When olive was presented, they paused. They did not remember chromium, but now they knew that this colour was not called green or brown. A single exposure was enough to begin a reorganisation of their colour lexicon. Carey argued that children are quick to notice new words and to assign them to broad semantic categories. After hearing chromium just once, the three-year-olds assigned it to the semantic field of colour names. A single exposure was enough to cause them to reorganise their semantic field of colour terms (Carey, 1978a). However, only one child had established full mapping, by the end of six months.

Before the introductory event took place, the child was presented with a colour identification task and the child's preferred term for olive green was established--usually either as green or brown. In the first encounter with the term, the possibility for the child to gain the full meaning of the new term was allowed; but Carey did not specify what "full meaning" entailed. Here the child was asked to: "Bring me the chromium tray not the blue one," there being only two trays available. In this first encounter the child was clearly not required to pay specific attention to the new word, per se. After the introducing event, Carey plotted the development of the new colour term over a period of six months, both in a natural playgroup situation and in a number of production and comprehension tasks. Over the six-month testing period, two distinct forms of responses emerged: one group of children interpreted "chromium" to be a synonym of green, whereas the other group of children seemed to realise that olive was an odd colour requiring an odd name but did not necessarily produce this name.

Carey (1982) has argued that the way forward in the building of a theory of semantic development is: a) to examine the role of the linguistic context in which a child first meets a word and to assess the child's use of this information; b) to isolate, if possible, any short-lived hypotheses that the child might entertain; c) to consider whether differences exist between the types of words that children learn; d) to examine whether constraints on human concepts rule out meanings that children might entertain; and e) to assess whether any differences in children's concepts, and hence, meanings, constrain a theory of semantic development (cf. Levine & Carey, 1982).

The Studies of Dockrell and Campbell (1981).

Dockrell and Campbell (1981) were interested in knowing the ways in which children map the meanings of novel lexical items. They argued that the child's data bases, the time and type of exposure, and the word class must be clearly delineated in order for a coherent picture to emerge. They were concerned with the ways in which children manage to map the meanings of novel lexical items and to outline some aspects of the child's contribution to the word learning task and the potential source of problem-solving information available to the child. They argued that short-lived, incorrect hypotheses might give a significant insight into the word-learning process.

Dockrell (1981) adapted from Brown (1957) the technique of using nonsense words in order to reduce the semantic information available to the child and thus to force the child to focus on other sources of information in order to infer the meaning of the unknown item. Based on six experiments in her doctoral work, she drew distinctions among sense, reference, and denotation as criteria against which to assess a child's full meaning of a term and to test the acquisition of unfamiliar terms in the vocabularies of three- and four-year-old children.

In one of her experiments, Dockrell chose an animal term rather than a colour term to present to her subjects. (She thereby avoided the complexity of the nature of colour vocabulary, the fact that colours lying on a perceptual continuum may make the isolating of the appropriate range of denotation difficult for children). Thus by using an animal term she was able to present her subjects with a distinct perceptual entity. Furthermore, children's knowledge of animals seems to be fairly well-differentiated even at young age. She argued that there were data bases that the children may use if the inference "Y is an animal" was established. The question she asked was: "How does the child learn a new word that fits into a firmly established conceptual framework?" She designed the experiment so as to give children a series of quasi-natural contexts in which to develop the meaning of the new word. The goals of the experiment were:

1) to explore the child's ability to acquire a new animal term;
2) to explore the child's ability to produce and comprehend this term in natural conditions with peers;
3) to investigate whether the child does associate the new word with a particular type of animal;
4) to examine if the child associates the new word with a particular type of animal, how the new term relates to the general concept of animal. For example, is it ascribed with animate characteristics?

Working with the artificial word "patas," which stood, in her study, for a tapir (a South American animal), Dockrell received 100% correct answers from her young control subjects. Her subjects seemed to know that "patas" could not refer to a cow, a sheep, or a pig--other animals that were used in the test sample--since their names were already known.

In the patas example, the child's mental model of the world assigns the three familiar animals to known categories associated with known words (cf. Johnson-Laird, 1977). The fourth animal, the unknown tapir, is assigned to an unknown category. When the child hears the instruction "Give me the patas," the form "patas" is assigned to a phonological structure and a syntactic structure. But its semantic structure is unknown. The child's understanding of the frame "Give me the ___!" and the child's mental models determine the response. Because the pig, the cow, and the sheep are preempted by their known category labels "pig", "cow," and "sheep," the child gives the tapir to the adult. The child may derive from the experience: a) that a patas is an animal name just like a pig, a cow, and a sheep, b) information about word sense, c) the information that its denotation includes animals like the tapir. Since the child in the study saw four animals--a pig, a sheep, a cow, and a tapir--and was asked "Pass me the patas, not the pig, the sheep, or the cow, but the patas," there was little choice in deciding to what the new term might r information available to the child. They argued that short-lived, incorrect hypotheses might give a significant insight into the word-learning process.

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A vital point here is if the lexical entry for patas contributes something to the child's response (Campbell & Dockrell, 1986), since there is doubt if there is a lexical entry; rather, comprehension and proper use of the word in the given context; and three-year-olds performing with 100% efficiency on the task. Dockrell has argued that this observation calls for certain methodological principles in research on semantic development. These principles must be such that one can disentangle from the child's use or comprehension of a word the contribution that the lexical entry makes to the response.

As regards the data bases that children have regarding an object or an attribute, it seems clear that they influence the word-learning process. A semantic framework into which the new word can enter appears to be more important for representation of the sense of a term than for representation of its denotation (Dockrell, 1981). Dockrell has argued that the initial contrast determines the semantic frame. Such a frame shows that children know that relations exist between words and it allows the new term to enter into these word-word relationships. This semantic frame may not be a necessary prerequisite for the development of sense relationships.

The conclusion is that lexical and strong perceptual contrast in one particular semantic domain allows the child to be extremely adept at picking up certain aspects of a word's meaning. This is an extremely useful strategy for the early word learner, Dockrell concluded. The children's results might have been very different, as she points out, if a) more unknown animals, for example, had been present, b) if the contrast had been purely linguistic, for example, "I like cabbage, not aubergines," or c) if the new word had been preempted.

Campbell and Dockrell (1986) argue that using the threefold distinction of a word's meaning "forces quite specific guidelines for a child or adult with knowledge of a word's meaning and allows an analysis of the criteria which form the basis of a particular meaning" (p. 124). Besides, from this perspective, different words are possibly learned in different ways by the same child or the same word could be learned in different ways by different children.

"Meaning" is not seen here as simply "full" or "partial." It is either "full" or one of various types of partial meanings. One important conclusion from Dockrell's studies is that the analyses of partial meanings are extremely informative about the processes underlying the child's acquisition of novel words. She has also argued, on basis of her data, that children have difficulties in stating what they know about a particular lexical item, particularly when they have knowledge of a given term. Thus, the knowledge underlying word meanings is tacit; the child is not aware of the knowledge s/he has of it. Not only is the child not aware of her or his knowledge about a word's meaning, but frequently the tacit understanding of the term, as viewed in spontaneous production and comprehension, does not necessarily reflect what the child says about the term. Acquiring a word's meaning according to these data, strongly indicates that the child is quick at mapping new words to proper semantic fields but that working out the proper denotata takes much longer (cf. Miller & Gildea, 1987).

1.3.3. Studies of Intentional Versus Incidental Learning.

Finally, I review a pioneering study on intentional versus incidental learning. The arguments on which this study was based have direct bearings on the experiments to be described in this thesis--namely, that mechanisms underlying the acquisition of complex materials such as the processing of language are sometimes analytic mechanisms and sometimes holistic mechanisms. This is the study of Aveling (1911), which has served as groundwork for later studies, such as the studies of Brooks (1978) with adult subjects, and the studies of Kemler-Nelson (1984) with children, both of which explore intentional versus unintentional acquisition mechanisms.

The Study of Aveling (1911).

Aveling (1911, 1912) conducted research into the relationship of thought process and percept in perception. He argued that a close connection existed between the thought processes involved in perception, and the sensorial contents of the percept. He wanted: "to determine the manner in which a given stimulus would be perceived -by an ideational preparation of the observer, corresponding to different kinds of perception, and secured by the giving and acceptance of the instruction" (1911, p. 213). Aveling maintained that the group of sensorial contents entering into the complex of the image is perceived as a type of this or that class, or as an individual of this or that kind.

Aveling presented his adult subjects with pictures of objects perceived in three different backgrounds. The subjects were divided into two groups. One group was instructed to try to perceive the pictures of the objects as individuals; the other group was instructed to perceive them as types, or generals (1911, p. 214).

Aveling reported that these types of instruction had a pronounced effect upon the subsequent perception of the subjects. The result was a striking difference between the two groups in the structure of the percept and in the related phenomena of consciousness, he argued. Constant differences were found in the sensorial contents of the percepts that corresponded to the differences in the thought processes. Thus, the group who had been instructed to perceive the pictures as types of classes of similar objects was seen as notably less exact and faithful to the originals than was the group that had been instructed to perceive the pictures as individuals. It seems that analytic rule formation (intentional learning) guided the responses of the former group but memory for individual instances (incidental learning) the nonanalytic responses of the latter group.

In sum, quantitative differences in responding were not substantial between the two groups but the type of encoding, however, had a clear qualitative bearing for the results. This result is in line with the arguments I stressed in the opening pages for this thesis: that perception and cognition are intertwined and have clear bearings for the function and adaptation of the person in the world (see p. 3-4). Later experiments have resulted in similar findings, such as the Lepton experiment of Lee Brooks with adult subjects (1978), and Kemler-Nelson's experiments with children (1984).

In his Lepton experiment, Lee Brooks (1978) employed the dichotomies intentional/incidental or analytic/holistic by working them out in a few different encoding conditions with adult subjects. On basis of his data, he argued that the more complex a behaviour is (speaking or writing, for example), the more likely it is to be learned implicitly. He pointed out, however, that the dichotomies explicit/implicit, analytic/nonanalytic, and deliberate vs. intuitive processes need to be elaborated and not taken as a strict division.

Kemler-Nelson (1984) in a series of intentional vs. incidental learning experiments with children argued on basis of her data that the holistic relation of overall similarity in natural, human acquisition plays a much greater role than hitherto acknowledged and that young children, for example of 3 to 6 years, would be more likely to use family-resemblance concepts and holistic processing than concepts based on selected attributes and analytic processing, as older children and adults would be likely to employ.

In the following pages I shall describe the tenet of experimentation in this thesis and how I hypothesise different types of instruction or encoding (my intentional and incidental conditions) to result in subsequent but different perception, cognition and function of the participating subjects.

1.4. The Tenet and Aim of Experimentation.

In the following, I describe the tenet of experimentation and the general aim of the research presented in this thesis and discuss the main theoretical notions underlying the research together with the methodology and the basic experimental design that was employed.

As stated earlier, (see Ch.1, p. 1-8), Joos (1972) has argued that the safest course in deciphering an unknown word is to assume the least meaning consistent with the context: a word should be defined in such a manner as "to make it contribute least to the total message derivable from the passage where it is at home" (p. 257). This least meaning, though inevitably wrong, includes the correct meaning and converges on it through intersection with least meanings inferred from future encounters with the word.

The basic aim of the developmental studies outlined in this thesis is to demonstrate a corollary of Joos' Axiom, viz. that a child in the process of acquiring a new word should be given time to decipher its meaning. Werner and Kaplan's (1950) "Word-Context" task forces subjects to infer the full meaning of an unknown word. As can be implied from Joos's Axiom, such inferences are inevitably erroneous and recovery from them is problematic.

Joos has argued that the process of deriving a complete meaning occurs without the individual being aware of the process and that the final understanding would manifest itself apparently spontaneously. How would this principle of semantic discovery work for the young word learner? The process of co-ordinating information from various sentences about the meaning of a new word would occur, according to Joos, without the subject's awareness. This idea of lack of awareness fits well with the processes of semantic reorganisation that Dockrell's (1981) data suggests are spontaneously occurring in the child. The precise meaning of the new term would be acquired through a process of semantic reorganisation and with further experience with the word. This dual process might be hampered if the child is required to make a precise guess as to the meaning of the new term. The child's representation of new lexical items change slowly over time when no information is encountered.

Thus, semantic reorganisation may be a holistic process governed by rules of gestaltist, organisational principles leading the child to privately creative and insightful word meaning solutions, the distinction between self and other such selves, and the environment being constantly in a state of flux, his/her idea of self and other/others ever unfolding depending upon the perception of qualitative differences between outside and inside stimuli (cf. Notterman & Drewry, 1993, p. 103-113).

The Processes of Semantic Reorganisation.

Dockrell (1981) uses the following example to illustrate how Joos's Axiom would possibly work with the young word learner.

> Let us imagine that the child encounters the following sentence: "The children are playing with the <u>lud</u>." Now if the child is required to or naturally makes a precise guess as to the meaning of <u>lud</u>, he might well say "ball." However he will find himself in considerable difficulties if he later encounters the sentence "Daddy is taking the <u>lud</u> for a walk." The initial specific guess "ball" is inconsistent with this second encounter. If on the other hand the children follow Joos' maxim, all that is required is a very general guess, viz. "something children play with," and on the second encounter this initial guess would need to be co-ordinated with the second context, viz. "something that is taken for walks" (p. 271).

The literature (Bowerman, 1978, 1981, 1982; Braine, 1981; Gleitman & Wanner, 1982; Karmiloff-Smith, 1986) suggests that conceptual representations may be actively changed while the child is in the process of learning words. Children often seem to be unaware of this knowledge. It is tacit; they are not only unaware of what they know about a word's meaning, their tacit understanding of a term, as viewed in spontaneous production and comprehension, does not necessarily reflect what they say about the term (Karmiloff-Smith, 1979). Experimental evidence shows that children have a great deal of difficulty stating what they know about a particular item (Litowitz, 1977; Dockrell, 1981).

Dockrell argued that there was a need to create research situations in which the child could encounter an unknown word at more than one instance of encoding, where the child's hypothesis is suggested in the first instance and a different meaning is predominant in the next instance. Thus the child must assimilate the information from both encounters with the term to work out the correct denotation and sense. It is important to create research conditions in which the child is not required to give the precise meaning of a word immediately after hearing the word. The child could thus hold specific criteria with respect to the meaning of the new word until further instances were encountered. The child has no way of knowing whether the initial guess is correct until the term is met again, since, if Joos's Axiom is correct, the child initially endows a novel lexical item with the least amount of meaning given the initial context.

In the studies undertaken for this thesis, there will be an examination of the nature of fast mapping and the type of information the child uses in such a mapping. The nature of these mappings may vary between word classes but in these studies only the child's acquisition of nominals is examined. There is evidence from Dockrell (1981) that in the case of fast mappings for relational terms in contrast to nominals, certain contextual elements may be more salient than others. For nominals, the degree of similarity to the prototypical exemplar of that category may feature strongly in the fast mapping. The relative importance of syntactic, lexical, and conceptual elements in the fast mapping may be specified.

Campbell (1979) speaks of the distinction between phenic and cryptic representations in order to account for disjunct representations of a term. It is possible that the child's production and comprehension of a given term are processes employing cryptic representation occurring without the child making inferences about the meaning of the term. When we ask the child to make a conscious rational decision about the meaning of a term, the process may involve a phenic representation that is not yet available for use. It is at the same time clear that children's representations of the new lexical item change slowly over time when no information is encountered, indicating that cryptic processes may be involved in word learning.

> A disjunction between the child's two representations of a new term is noticed in Dockrell's experiments. She cites the following example of such a disjunction:So, for example, Andrew (pattern group, specific pattern strategy) behaves as if <u>gombe</u> denotes <u>tigrine</u>, and clearly distinguishes

between shape and colour terms, but cannot explicitly distinguish between shape, pattern or colour with reference to 'gombe'. On the other hand, Anna never responds as if gombe denotes colour, does respond as if gombe can denote shape, yet on occasion denies it is a shape and says it is a colour. There appears to be a disjunction between the children's two representations of the term (Dockrell, 1981, p. 272).

Reference, Denotation, and Sense.

A useful way of analysing the process by which the child acquires words is to use Lyons' (1977a) distinction between the "reference," "denotation," and "sense" of a word, which helps to clear the relationship between words, concepts, and the world. Reference is the relationship between an expression and the entity in the world the expression is supposed to identify. Thus a speaker who says: "That's a cat," is making reference to some entity in the world, or, as sometimes is the case, to different entities. Reference is thus a way of using words. Denotation is the relationship between a word and the world and is independent of particular utterances. A word used to refer to one entity of a class can also be used to refer to any entity of the class. This class of entities to which a word can refer constitutes the word's denotation. The denotation of a word is taken to be the concept to which the word is mapped, as in the studies by Dockrell (1981). Her studies were aimed at learning about the mapping process when the child maps a word onto a concept. Thus, she studied the process of establishing the denotation of a word.

Intension is the idea of properties, definition of concepts like "blue," and is often linked with a word's connotation. Extension is a category, i.e., the extension of blue is a set of blue things in the world. The property or properties of blue, for example, is a matter of context. Blue has a different meaning according to context. Denotations are different in different contexts and are often linked to extensions. Some words have very well defined categories; others such as size adjectives examples "long," "thick," "large," do not. The adjective "blue" denotes a set of things such as blue car, the adjective "brown" denotes a set of animals such as brown dog; as soon as a noun is stuck to the adjective, the noun determines the set. Adjectives are syncategorematic: they have meaning only when attached to other words.

There are two aspects of meaning that should be distinguished. According to Bierwisch's paradigm (1981) these aspects are organised according to independent but interacting principles: semantic structure determined by the rules of language and thus pertaining to the realm of tacit linguistic knowledge and conceptual structure that is based on rules in terms of which mental representations of the world are constructed (see also Bierwisch 1970, 1980).

Lyons (1977a) calls the various relations of a term with other words, *sense*. Examples of *sense* are relations of synonymy, contrast, opposition, hyponymy, and superordination.

Dockrell (1981) introduced the "Concept of Full Meaning," of sense, reference and denotation (SRD), a distinction that clarifies the understanding of the notion of meaning, and, by doing so, provides a framework for assessing the child's competence by analysing full meaning in terms of the components of sense, reference, and denotation, it was possible to pinpoint the difficulty with any particular component of the word-learning process, i.e., which component of meaning caused the difficulty in the word-learning process. What components of meaning are present in a partial representation of a term can now be stated: either sense, reference, or denotation. She suggested that "the SRD distinction clarifies our conception of the word-learning process, adds precision with respect to the variables involved in the mapping process and allows us to define meaning in such a way as to be able to make predictions about the processes involved in acquiring the meaning of an unfamiliar word" (p. 287).

The aim of the research presented in the thesis is to study the formation and subsequent representation of semantic categories of 4- to 12-year-old children. The child is studied as a word learner and characterised with the use of a particular methodology and a three-fold distinction of word meanings. The research is based on the argument that knowing the semantic domain of a term that is the word to which the term is closely bound by sense relationships helps to create the boundary conditions for application of that term. An attempt is made to determine the sources of information that children have available, in an attempt to arrive at an initial reference and a stable denotation of the new term. The child's ability to acquire a new term will be influenced both by the nature of the term and the type of experience leading to its acquisition. The type of encoding that the child employs in the experimental situation is predicted to influence his or her decoding (cf. Aveling 1911, 1912; Brooks, 1978; Kemler-Nelson, 1984).

Campbell and Dockrell (1986) argue that *contextual constraints* provided by situations in the real world may assist the child in creating meanings for a word and that the child's early experience of such terms is likely to be in context, which, in turn, may guide his or her initial hypotheses about possible meanings of a word. It still must be explained, they argue, how the child proceeds from performance in canonical situations to an acontextual meaning.

What the child in an experimental setting learns about a novel lexical term may depend upon *the nature of the term*. Learning verbs, for example, may be different from learning nominals, as has been suggested by both Bowerman (1978) and Dockrell (1981).

The studies being undertaken here and described in this thesis are concerned with the child's acquisition of nominals, but in the case of new terms denoting objects, the child seems to acquire information pertaining to the object per se. When the child can isolate a correct object in a situation, the child is indicating that she or he is sensitive to the cues that the researcher presents--cues that indicate the intended level of specificity (Brown, 1957, 1958). Children who do not isolate the intended level of specificity will not be able to infer that a new word denoted some previously unnamed natural kind. In the studies, the child's acquisition of natural kind terms is probed. It has been shown that young children do well with sorting tasks when they have to group members of a natural kind, a complex cluster of attributes (Nelson, 1974, 1978, 1985). Use of a single attribute as a basis for sorting or matching, on the other hand, is a much later acquisition (Vygotsky, 1962). Despite the dense and related nature of the components of many nominal categories underlying natural kind terms, children at three or four years of age have been found to have an organised semantic domain for animal terms and even for other natural kinds like plants and fruit (Dockrell, 1981). Age level and effect of intervention are used as the main variables to estimate children's semantic knowledge and to examine how children determine semantic properties on the basis of syntactic cues to part-of-speech membership--the grammatical practice of allocating words to one or another part of speech. Nonsense words are used in order to replace the semantic information available to the child.

Comprehension and Production.

The language acquisition of young children is an extremely complex process and the acquisition rate is very rapid. By age 6, the average child is estimated to understand 14,000 words. If these words are learned between the ages of 18 months and 6 years, this works out to be nine new words a day, or as Carey (1978a) has pointed out, almost one word per waking hour. The average 6-year-old is also able to analyse language into its minimal, separable units of sounds and meaning; to use rules for combining sounds into words and words into meaningful sentences; and to participate actively in coherent conversation.

While comprehension entails only identification of the item referred to, production for the item is a cognitively more complex one, in which the child must select a word appropriate to the initial identification.

In production, a concept is used to generate a label and thus to reflect existing conceptual representations. Only existing instances of the concept can be appropriately labelled. In comprehension, a label is used to access a concept and then the prototypical representations can be used to predict new instances that should possibly be included along one of the relevant dimensions of the concept (McShane, 1991). Fewer underextensions but more overextensions in comprehension would be expected in this account. McShane (1991) suggests that false extensions will presumably be weeded out by various processes such as the later provision of alternative, more suitable words, which suggest another concept of the instance in question; or by the setting of boundaries on the concept by other means that lead to the exclusion of the instance from that concept.

Huttenlocher (1974) has suggested that it is easier for the child to recognise a word and recall its referent (i.e. to comprehend a word) than it is to recognise an object or event and recall its label (i.e. to produce the word) thus, comprehension involves a mapping from form to concept, whereas production involves a mapping from concept to form. But production is not simply the opposite of comprehension (Campbell et al. 1982; Kuczaj, 1982; McShane & Dockrell, 1983). Often the lack of correspondence between children's use of a term in production and comprehension has been thought to reflect task difficulty (Thompson & Chapman 1977). These methodological difficulties need to be elaborated further.

There may be great difference in the speed at which a given linguistic feature is acquired within the spectrum of "normal children." Various factors are involved, such as socio-economic background, sex, intelligence, opportunity, and motivation, and these affect the quantity as well as the quality of a child's comprehension or production. Within the range of "normal" development, a variation in rate of anything up to plus or minus six months is to be expected (Greene, 1975, 1986).

Whether an initial relationship between production and comprehension can be assumed is still questionable. At the same time it is clear that one must take both sources of data into consideration in an attempt to give a characterisation of the young word learner. These two systems must be evaluated in various contexts and with different classes of words in order to evaluate the relationship between production and comprehension. The more general finding is of overextensions in production rather than overextensions in comprehension. In these studies mentioned above, one must be aware of certain methodological questions such as whether the noticed lack of connection between comprehension and production is applicable to all lexical domains or only to especially complex areas such as colour vocabulary, and if the relation does vary with the linguistic competence of the child or with the nature of the child's initial introduction to a new term. Certain processing limitations may be used to account for some of these results (Dockrell, 1981). Also, one must be aware of the postulated differences between the learning of concepts and the learning of names (Macnamara 1972, 1982; Rosch 1973, 1976, 1978; Rosch & Mervis 1975; Rice 1980). The content of the children's speech is likely related, at every age, to their stage of general cognitive developmental (Clark, 1975).

Developmental differences.

Individual differences are expected to be quite substantial in the studies described in this thesis. Differences are expected both in rate of development and in characteristic patterns of use and probably also in learning. These differences have been well supported in recent work by Gordon Wells (1986b) on his research into the literature on variation in child language. The following studies will investigate a) the development of the child's denotational boundaries for comprehension and, if possible, production; b) the semantic representation of the new term in relation to other words in the same semantic field; and c) the importance of the linguistic input in determining the appropriate semantic domain. All these issues require that the child's knowledge of words is tested over time rather than in a single presentation situation.

There seems to be a clear indication that very young children, (two and a half to three years of age, at least) have a predisposition to form natural kind categories--categories such as those for animals, plants, and living things (Dockrell, 1981; Golinkoff, 1982; Gelman & Markman, 1987; Markman, 1989). The linguistic context in which the child first meets a novel lexical item is a source of hypotheses about the terms denotation and sense.

In the studies to follow, variables such as age and conditions will be examined. Age is known to be an important factor in such studies as those of Werner and Kaplan (1950), in which there is a strong developmental trend towards the full meaning and a great shift in performance at the ten-to-eleven-year level. Werner and Kaplan have suggested that this trend is the result of the increasing ability of older children to state their knowledge about a new word's meaning in a declarative form and that it further reflects their growing sensitivity for relation between grammar and meaning.

Children may have more knowledge available than they can access without proper retrieval cues. Like adults, they do not always have access to different aspects of their knowledge base (Winograd, 1975). The kinds of knowledge that are most difficult to access are those called procedures (or ways of doing things); knowledge that is generally accessible has been stored in declarative form. As Mandler (1983) says: "To the extent that a bit of information is embedded within a given procedure it may not be easily found and used when relevant to another situation" (p. 424).

In the case of practical anticipations, the context in which activities are carried out tends to be given heavy weight in the child's interpretation. There is thought to be a procedural basis of early knowledge organisation, said to be contextually embedded. Many early concepts seem to be tied to the contexts in which they were first formed, leading to such phenomena as underextension of word-meanings. The early organisation of knowledge around scriptlike activities may play a profound role in the child's developing conceptual life. Younger subjects may be more dependent on the representation of familiar sequences to guide their encoding and memory. A major developmental change is the gradually increasing accessibility of knowledge. The word needs to become decontextualised from the routine within which it had originally been embedded (cf. John Dewey, 1910). It needs to become productive and context-free. An important aspect of development is the gradual formation of a declarative knowledge system from the continued applications of procedures.

Bruner (1964) has suggested that a change in the child's representational system is thought to occur around age six to eight when this system becomes more symbolically and linguistically based. Having gradually mastered the linguistic rules involving categorisation and hierarchical structure, the child learns to apply them to conceptual categories as well. During restructuring, differentiation and elaboration of acquired knowledge is thought to take place.

In the studies to follow, the lack of attention exhibited by the younger children is expected to produce a less detailed representation, but does not imply that their representations of the new words are fundamentally different in kind from those of older children and adults. It is clear that many factors other than the underlying nature of representation itself can account for performance as well. Besides, as Fodor (1975) has pointed out in this regard, children, rather than progressing from level to level (as Bruner suggests) may have an uneven development, thus reaching high levels of sophistication in some phases and fields while remaining naive in others. Nevertheless, performance is expected to be influenced by the effect of schooling experience that has shaped and restructured earlier concepts of the child and furnished him/her with new methods of thinking. Thus, a developmental sequence towards a more accurate understanding of the meaning of the new term is predicted.

The extent of the age change is expected to be affected by experience in the knowledge domains and new events are expected to be comprehended through a bottom-up or data-driven processing, which gets blurred with less likelihood of recovery in intervention conditions: the hypothesis being that the blurred perception of language influences cognition and the subsequent adaptive functioning of the child.

To summarise, then, in the studies undertaken for this thesis, transition from context-bound to more context-free knowledge is expected to take place in the process of semantic reorganisation. Children gradually become able to access knowledge beyond the demands of the immediate (procedural) context with growing age. Their increased accessibility is manifested in the ability to recall absent things, to locate an item in memory without any current perceptual support, and to give logical definitions of the meanings of words.

1.5. The Experimental Design.

A study (1984) that I conducted into the comprehension of the words "more" or "less" (with one unfamiliar control word "tiv") in the vocabularies of 48 children (4- and-5-year-old), was the forerunner to my doctoral studies presented in this thesis. The results conflicted somewhat with predictions from earlier studies (cf. Donaldson & Balfour, 1968; Carey, 1978a); the prediction from these studies being: a) that the order of development goes from more being represented positively as (+) quantity before less but a noted inability to relate text to context correctly in ambiguous situations; or b) more being correctly represented as (+) quantity, (+) pole and the child being able to pick out the relevant features in the context; less being recognised as the polar opposite of more and requiring similar strategies in picking out the correct features.

My results did not give a base to postulate either that quantity was worked out before polarity for both terms, or that polarity was worked out before quantity for both terms. The percentage of correct answers to more in the older age group (mean age 4.6) was 83.3% as compared to 59.6% in the younger age group (mean age 3.11); the percentage of correct responses to less was 62.5% in the older age group as compared to 55.9% in the younger age group, the percentage of correct answers to the control word tiv in the older age group was 55.6% as compared to 36.8% in the younger age group--as can be seen, there is small difference between the correct answers to more and less in the younger age group.

The experiment encouraged the need for further interpretation of quantitative terms. However, the experiment shed light on the development of more or less by taking into account a wider range of factors relevant (the target words were incorporated in a story format with accompanying non-linguistic contexts--pictures of different objects and of different colours that related to the theme of the story; a few familiar colour terms were asked about; the colour "orange" proved most difficult for the younger children, this result perhaps evidence for pre-emption: the young children confusing the noun "orange" and the adjective "orange," thus failing to relate text to the non-linguistic context--the colour term lexically captured by the noun term). (See the story employed and photos of the stimuli pictures in Appendix A, p. A1-A3, Fig. A.1., A.2., p. A4-A5).

The experiment gave a clue as to the validity of asking children what they thought about their reasons for their answers, a technique that I have adopted in my later studies. Older subjects, for example, when asked directly to state why they thought less was not of as great quantity as more, said: "It is not as much as that," and pointed to the relevant objects in the pictures (suggesting that they used simple comparisons).

In one of her experiments, Dockrell (1981) modified Brown's technique (see p. 12-13) and presented a pictorial task to the child. She used four choice pictorial stimuli, one item depicting the correct referent, another depicting a similar but incorrect referent, a third depicting the original context excluding the correct referent, and a final one that was totally irrelevant to the original picture.

In my own experimental designs, whether using pictures or objects, I have adapted Dockrell's modifications of Brown's method. A group of test stimuli was designed for my studies which focused on different elements shared with the target referent. In the sample, one object, picture, or material would stand for the correct referent; a second would stand for a similar but incorrect referent; a third would have some similarities but would not share as many characteristics as the target referent.

What criteria does the child use for restricting and extending the denotation of a new term and what kind of relationship eventually holds between the various denotata such that they form a coherent whole--a concept? The studies undertaken for this thesis are designed to assess the denotational boundaries of the new terms and the ways in which these boundaries change over time. As has been stated by Anglin (1977) and by Bowerman (1978), the future development of a word's meaning begins from the first referent for which a word is used. The learning process is completed slowly after this first mapping by repeated encounters with a word in a number of specific contexts (Campbell, 1979; Carey, 1978a; 1978b; Clark, 1973a, 1973b, 1975; Dockrell, 1981). Since acquiring the meaning of a new word is arguably a lengthy process, these studies will attempt to trace its progression from the child's initial encounter with the term to a later stage of posttesting, when a case for the existence of full meaning can be made.

In these studies, "word-context" tasks were presented to children aged 4 to 11 years. Subjects encountered an unknown word four to six times in a story format. An important difference between these tasks and those of Werner and Kaplan is that care was taken to make sure that the target meaning was not already "captured" by a known word. A range of conditions explored the effects of asking subjects to guess the meaning of the unknown word after each encounter. In the control conditions, subjects were asked questions about events in the story; in the experimental conditions, subjects' knowledge of the unknown word was assessed by direct or indirect methods. At the conclusion, all subject groups were fully tested for knowledge of the unknown word, using methods developed by Dockrell (1981) to test for full meaning, including the sense and denotation of the new term.

One control condition and several experimental conditions, which differed among the three studies, were employed in this research. In the experimental conditions, the experimenter intervened at predetermined points in the story in a more-or-less direct fashion, in order to test the child's knowledge of the new term. Thus, the child was obliged to think about the new word on a number of occasions. In at least some of these occasions, so little information was available to the child that his or her guesses about meaning were often incorrect. On the other hand, these interventions necessarily employ the novel term and so provide learning opportunities. In the control condition, intervention took place as well, but only to check on the child's general understanding of the narrative. No questions, direct or indirect, were asked about the target word or other unfamiliar words. In the case of the control subjects, the learning conditions were more incidental and holistic, as the child's information processing regarding the novel lexical item was not disrupted.

Under the incidental conditions used in the studies (the control conditions), the subjects were given scope to co-ordinate in a holistic manner the various aspects of the new word's meaning in several verbal contexts. Under the intentional conditions (the experimental conditions), subjects were required to test their guesses about the meaning of the new word at predetermined points in the story. Asking the "intentional" learners to define the new term's meaning directly or indirectly, whilst in the process of encoding, was expected to foster more analytic learning; whereas allowing the "incidental learners" to encode information about the new term without interfering was expected to foster holistic learning. This design bears resemblance to those of Aveling (1911, 1912), of Brooks (1978) and Kemler-Nelson (1984) conditions.

It was predicted that "full mappings" would be more likely to occur, reflected in the lexical entries of subjects' performance patterns, under the control condition. Subjects in the control condition were thought to have gathered enough information about the meaning of the novel items through their implicit and indirect encounter of it, and did not have to guess about its meaning too early. "Fast mappings" or incomplete lexical entries, as reflected in subjects' response errors, were predicted under the experimental conditions, which provided the subjects with somewhat ambiguous and unstructured alternatives. Age was thought to be a very important factor. Older children are capable of more sophisticated reasoning and so older children were expected to reap greater benefit from the additional exposure to the novel word that intervention provided than were the younger subjects.

It was expected that the control conditions would not be inferior to experimental conditions, despite the much greater exposure to the unknown word enjoyed by subjects in these latter conditions. With younger subjects, the control groups were expected to perform even better, with great individual differences. The subjects in the experimental groups, although making the errors predicted by Joos, were to an extent predicted by the hypothesis to solve the problem of recovery.

The story topics were selected with a child's interest in mind. An account of the developmental progression of word meanings with age was expected, and this effect was examined against performance in tests under various conditions. These studies were designed to yield information about the processes that operate as children extract information about an unknown term from the sources of textual context available during encoding.

The Technique of Using Drawings in the Studies.

The development of the technique of using drawings in the language studies described in the thesis has been suggested by works of many authors. Aveling (1911, 1912), whose research I cited earlier (see Ch.1, p. 19-20), used drawings to estimate the encodings of his subjects together with their verbal responses of introspection. He investigated in his adult subjects the effects of different types of encodings of pictured objects and how they resulted in different types of decodings of the pictured objects. He found that instructions to his subjects influenced their responses; he discriminated between two types of responses--analytic responses that were based on the general rule or class of the pictured objects and nonanalytic responses that were based on instantiated memories of the pictured objects. Aveling is one of the earliest researchers reported to use drawings in this regard, an activity that I decided to adopt from him and to use in my experimental designs together with his ideas of the influence of instruction and of different encodings resulting in different decodings.

Recently Mandler (1983) has argued that it is not good to equate verbal production with conceptual understanding and that nonverbal measures can often tell more about the child's classificatory systems than can verbal ones. Using drawings as an assessment tool of the nature of the young child's imagery was a much-employed method in the studies of Piaget and Inhelder (1971), in which children's symbolic representation was used to study their representation of knowledge. Their drawings were seen to yield information about their knowledge (Goodnow, 1977). However, even if drawings are influenced by what a child knows, Freeman has recently suggested that, as all drawings involve the labour of production, they require complex rules of their own (Freeman, 1972, 1976, 1987). Bearing in mind that there is a difficulty in separating a child's knowledge of pictorial conventions from the content of a child's internal representation, the technique was adopted in the present study; drawings are thought to appeal more to younger children as a means of expressing themselves about the meaning of a new word (Lowenfeld & Brittain, 1975). It is possible that young children rely more upon imagery in their thinking than they do on verbal mechanisms (Arnheim, 1969; Paivio, 1971, Paivio & Csapo, 1973). However, as

Fodor (1975) holds. even if children are quite attentive to the visual and open towards it (thinking about the visual aspect of things) that in itself is no proof that they are thinking in images (thinking with visual representations). Bearing this sceptical argument in mind. I. however. cautiously adhere to the pioneering procedure and empirical approach of Aveling. and those who followed.

Thomas and Silk (1990) have reviewed the literature into children's drawing development. They discriminate between three main theoretical approaches to the problem: a) constructivist theories that stress the ways in which pictures must be constructed by using graphic devices to achieve pictorial means; b) ecological invariant theories that point out the extent to which natural perception and pictures are often concerned with the general appearance and structure of scenes; and c) gestalt theory that provides an analysis suggesting that one's responses to certain forms and patterns may be innately determined by the operation of Gestalt laws of perceptual organisation. of the organisation that is brought to sensations; the Gestaltists postulating that reality was based on perception that again depended on the bringing of coherence or organisation to the sensations and the stimuli that evoked them.

However, each of these approaches is partial, as each one explains only some features of pictures.

Freeman (1987) has proposed that a child's drawing development is largely the developing mastery of graphic skills. Any piece of graphic work can be seen as a set of parts or units combined into a whole or pattern. Goodenough (1926) suggested that children's graphic work illustrates their thinking and problem-solving. Graphic work is seen for children as truly "visible thinking" and this is seen as true for adults also. Such graphic work displays were the main features of thrift, conservatism, principles of organisation, and sequence.

How does the child develop the means of representation and expression? In the literature it has long been thought that a child's drawing directly reflects mental images or concepts (Barrett & Light, 1976). Recent research, however, has demonstrated the complexities of the drawing process and how this process shapes the final drawing product (Freeman. 1987). The task demands of the drawing process are thought to interact with representational intentions in the way that the child uses graphic devices for a variety of representational purposes.

Lowenfeld and Brittain (1975) stress the actual act of creating, the process of making a drawing as an indivisible part of the overall mental and developmental progress of the child. They further argue that the child's first attempts at drawing symbolic pictures may not stem from visual stimuli or from concepts or ideas. Other channels of perception, such as the sense of touch that is awakened when the child holds an object, may be of as much importance as seeing the object and understanding its role. They stress the importance of aesthetic growth in the child, as did Kellogg (1969).

Generally, the use of drawings in the studies is based on the assumptions that early drawings, though not easily recognisable to observation may have been intended as representations by the child who produced them, (cf. Campbell & Harrison, 1990), and, that drawings are not only "internal models" or figurative schemes of objects,--as Piaget would have postulated--but that, children's drawings are influenced by the pictures that are available to their experience in their environment. Thus, children may "invent graphic symbols" comparable to their invention of the rules of language that gradually come to represent the rules of their language community, and, they may also, co-ordinate various cognitive units to invent a novel solution (Lange-Küttner & Thomas, 1995, p. 105).

Vygotsky (1962) stressed the functional role of drawings in the overall development of the child in the cognitive, emotional and communicative domains. His cultural-historical approach to human development and his view on the instrumental mind and the need of the child to relate thought to concrete action/experience focused: "on the meaning of the child's achievements in the domain of drawing for his or her life in a real world, in a given socio-cultural context, as a member of a human society" (cf. Lange-Küttner & Thomas, 1995, p. 147). This Vygotskian perspective is the theoretical base for the application of a drawing test in the experimental designs presented in the thesis.

Experimental Proceedings.

A problem in much of the modern research on language development is the small size of the samples used. Such samples may be justified as a means of developing hypotheses, but are hardly sufficient to develop causal relationships (Wells, 1986b).

It is not until a fairly detailed account is available of the common trends in development that one can, indeed, make systematic assessment of the extent to which there are significant individual differences. Now there is good evidence for substantial variation in rate of development. Why do these differences exist, how do they correlate with subsequent developmental indices and to what extent are they open to modification? In order to investigate these questions, patterns of covariation between linguistic indices and other attributes of children and their experience, which vary across the population, must be evaluated (Wells, 1986b).

Larger samples are needed if one is to take systematic account of even one or two of the multiple sources of variation, whilst at the same time obtaining data amenable to detailed linguistic analysis. The study of variation is necessarily quantitative and such analysis involves counting in one form or the other. On the basis of this rationale, it was decided to use large samples in the developmental studies.

The pilot testing of materials for Experiments 1 and 2 were run with a group of eight children in Balquhidder Primary School in the Glen of Balquhidder, to ensure that the requirements were not too complicated for the children and that the intended nonsense words could be decoded by primary school children of normal intelligence. The Experiment 3 pilot was run with eight children from Balquhidder Primary and the Psychology Department's Playgroup at Stirling University.

The scoring procedure for the three experiments was two-fold. On the one hand, it involved the reading of all the protocols, in order to classify definitions and responses given in the Encoding Phase. On the other hand, it involved scoring responses from the Test Phase and Posttest Phase for each of the tests used there. Responses were given a score of 1 when correct and 0 when incorrect. Various statistical tests were run on these responses, such as t-tests, Chi-squares, Anovas, and the Duncan Multiple Ranges Test in order to give a clarification of the main trends in development as a function of the three main variables: Age, Sex, and Condition. Analyses based on these will be further explained in each of the following experimental chapters.

To summarise, then, in the studies described in the thesis, an attempt is made: a) to trace the development of word meaning over time and to discover the development of the child's denotational boundaries and b) to examine both the child's comprehension and production of the new lexical item and the relation of this term to other terms in the same semantic domain.

The three following chapters describe, in detail, the three experiments that were undertaken for the thesis and analyse the results and discuss the main findings. Followed by these chapters there is a summary chapter in which I discuss the three experiments and their results and the consequences of the probing techniques. Furthermore, there is discussion of what the results tell about word use as compared to word meaning, of the applications of the results and the implications of the observations of the functioning child in the experimental settings, and, finally, some concluding remarks are given.

1.6. The Structure of the Thesis.

The present thesis is based on three developmental studies, all of which aim at examining implicit and explicit processes in the progression of the meaning of unfamiliar natural kind terms in the vocabularies of 4- to 12-year-old children over a period of 4 to 6 weeks. An attempt is made to demonstrate a corollary of Joos's Axiom: if a child is in the process of acquiring a new word she or he should not be asked too early in the acquisition process what the word means.

Since acquiring the meaning of a new word is arguably a lengthy process, one must attempt to trace its progression from the child's initial encounter with the term to a later stage when a case for the existence of full meaning can be made. In the three studies described in this thesis "word-context" tasks are presented to 4- to 12-year-old children in which subjects encounter an unknown word four to six times in a story format. Care is taken to make sure that the target meaning is not already "captured" by a known word.

Two to three experimental conditions are involved and one control condition. Under the control condition--the incidental (implicit) condition, subjects are given scope to co-ordinate in a holistic manner the various aspects of the new word's meaning in several verbal contexts within a story. Under the intentional conditions (the experimental conditions), subjects are expected to test their guesses based on the new word's meaning when intervened with at predetermined points in the story. Asking the "intentional" learners directly or indirectly to define the new term's meaning whilst in the process of encoding is supposed to foster more analytic learning, whereas allowing the "incidental learners" to encode information on the new term without interfering is supposed to foster holistic learning. Thus, the notions of explicit and implicit learning are tested in the thesis and compared against discussions of these notions in the literature.

CHAPTER 2
EXPERIMENT 1
A NOVEL MINERAL TERM

Introduction.

This chapter presents the first experiment conducted for the thesis. I start with a few introductory remarks: Shannon (1948) has argued that human language, far from conveying maximum information, is highly redundant, is highly predictable. Hill (1970) has called this principle of maximal redundancy "correspondence meaning," the correspondence between the occurrence of a linguistic item and a non-linguistic object, action, event, or the like. Hill maintains that meaning is never given by an item that is totally unpredictable. It only occurs when an item is one of a set of possibilities already defined by the contexts.

In the present study (Experiment 1), children were presented with a story in which the meaning of a new word had been sharpened with each section, but the precise meaning had been withheld through several steps. The learning of the meaning of the new word was the main object of study.

Joos (1972) has argued that the new item should be made maximally supportive and supported in its situation, a situation in which redundancy allows the subjects to predict that the task will require a great deal of deciphering. He argues for subconscious processing in the deciphering of word meaning. One must receive the message in order to define the new word in such a fashion as to make it contribute least to the total message. Resemblance or analogy is important, as the new term must be a symbol of a real world item that is familiar enough to the reader that s/he can connect the information with previous knowledge and experiences. Joos (1967, 1972) has argued that the tacit knowledge of situational context and experience are important factors in the "intuitive behaviour" of hearers when they are interpreting the meaning of an unknown word in a given text. Hill speaks of this tacit knowledge as Joos's law or as correspondence meaning and maintains that:

> If we then recognise that there is a difference between context within sentences and contexts reaching beyond sentences, many of our problems are resolved. In believing that the search for larger contexts to determine identity is justified, my reason is the truism that context does indeed give meaning, and that no hearer can understand the meaning of a sentence unless he knows the context in which it occurred (Hill, 1970, p. 254).

A child must be equipped with good general knowledge in a given domain and must be flexible in intuitive behaviour when deciphering the meaning of a new term from text. The flexibility in the attachment of meanings to words must be tremendous, but on the other hand, the complexity and ambiguity of the information must be somehow reduced (cf. van Daalen & Elshout, 1981).

Joos's thesis holds that a given word is redundant in a given text, i.e., that it carries little information. Johnson-Laird (1977) maintains that people cannot understand language without knowing something about the context in which an utterance occurs. People use general knowledge about the meanings that a speaker or writer is intending to convey. Thus, this behaviour involves high-level knowledge about the world (schemas), events that are likely to occur (scripts), and social conventions for different types of communication (story schemas and speech acts).

I would argue, however, that it is important to realise that language understanding cannot be completely explained in the light of general knowledge; linguistic skills come into play, as well as the child's perceptual sensitivity for the given situational context and how well these abilities handle interferences of linguistic materials.

Object of Study.

A developmental study was designed to trace the acquisition of a single mineral term--a two-syllable nonsense word that represented a mineral--in the lexicon of 160 children ranging in age from five to twelve years. The study tests the following hypothesis: Supplying proper information about a novel lexical item through an indirect and implicit linguistic encounter is a sufficient basis for the mapping of its meaning.

Tacit knowledge of semantic structures not only enables us to interpret the sense of a word within a given linguistic context by attaching the least meaning possible to it, but also to eliminate certain candidates for election as referent (Joos, 1958, 1972).

The ability to categorise, and thereby to form concepts, is a prerequisite to acquiring a lexicon. There is a clear indication that young children have a predisposition to form natural kind categories, also the type of concept most readily acquired depends on the characteristics of the task conditions and the learner.

Although no common consensus exists at present about what constitutes linguistic meaning, I thought it was necessary to have some sort of paradigm or yardstick to use in analysing the accumulated data. Therefore, it was decided, a "full meaning" paradigm would be employed in this study, with "full meaning" entailing knowledge about both the sense and denotation of the term in question. The child's "sense" of the novel lexical item was supposed to be exhibited by an understanding of the word's relation to other words in the child's lexicon. Knowing to which set of objects in the world the novel term referred meant that the child had acquired that component of the new word's meaning which is called denotation. With this in mind, and in order to avoid the problem of pre-emption, an unknown mineral term, "Mikas", a nonsense word that denoted an unfamiliar metal, was created for use in the study.

Metal, or mineral terms, being words that represent mass, take neither an indefinite article nor a plural. Therefore, in this study, I hoped to observe whether the child's sensitivity towards these distinctive grammatical features is developed in close interdependency with the mapping of the word's meaning. I also hoped to observe at which level of generality children of different ages first learn the novel natural kind term, and whether their application of it reflects a basic-level categorisation or a high-level one. Knowing the semantic domain of a term, the words to which the term is closely bound by sense relationships, helps to create the boundary conditions for application of that term. But to what extent do the types of categories that children form influence the type of meanings they entertain?

In Experiment 1, the development of the novel lexical item was plotted over a period of two months with children of four different age levels. Thus, the experimental approach combined both cross-sectional and mini-longitudinal methods.

The intention of the study was not to establish norms or a scale, however, but rather to seek a trend in semantic change and the acquisition of lexical strategies as reflected in the lexical entries of four different age groups, each of which underwent four different encoding processes for the novel item.

The Experimental Design.

The main experimental variables under consideration in the study were Age, Type of intervention, and Sex. The two main objects of the study were to observe developmental differences in children's acquisition of a new lexical item as a function of age and to see how three different types of experimental interventions affected the lexical entry for the unfamiliar word, with one control condition being run.

Subjects at each age level were randomly assigned to one of the four intervention conditions involved. The design called for 10 subjects in each cell of the 4 (age level) times 4 (methods) design. Thus the total sample of 160 subjects was split into 4 age groups of 40 subjects each and within each age level 4 subgroups of 10 subjects each, these 10 subjects comprising 5 boys and 5 girls.

Method.

In Experiment 1, the experimenter did not provide the subject with any specific learning instruction. Rather, the subjects' referential inferences were observed after the child was exposed, indirectly and implicitly, to the novel lexical item through the context of a story. This interference with the encoding process by indirect or direct questions about the meaning of the new term disrupted the information processing. Thus the subject lacked adequate information about the distinctive syntactic and semantic features of the novel item, and was, at the same time, confronted with a somewhat ambiguous stimuli material in the case of the indirect condition. Thus, it was predicted that this procedure would result in subjects' response errors, which would be temporary in some cases but more permanent in others, as a function of such variables as age and previous linguistic knowledge. Another important variable is the nature of the experiment itself and the conscious strain and linguistic labour of the subjects in the experimental conditions. At the same time it should be clear, however, that being manipulated indirectly and directly on the novel item, as experimental subjects were, gives subjects other contexts in which to decipher the meaning of the word.

The subjects were not given feedback on the correctness of their responses. In each of the six interval sessions of the story, the experimental subjects were not only asked direct or indirect questions about the novel lexical item they were in the process of learning, but were also asked direct and indirect questions about other words in the story.

In general, then, the linguistic and non-linguistic contexts and manipulations in the three experimental conditions might compensate for the lack of information about the semantic features of the novel term brought about by disrupting the encoding process. These manipulations might, on the other hand, force the subject to make a wrong guess. Experiment 1 pitted these notions. The subjects' responses were both written and tape recorded and observational notes were taken about the children's general performance and approach to the experiment, errors in responding, recovery from errors as a function of age and/or condition, and pattern of recovery were the main emphases of the observation. The particulars of experiment did not vary according to age, except that questions were slightly simplified for the youngest subjects.

In all conditions, the story context of the study was thought to be somewhat too complicated for the youngest subjects. Thus, their performance under these special conditions might not give a very accurate picture of their true capabilities in mapping the meaning of a novel lexical item.

Testing and Scoring.

Each child was tested twice: in a Testing Phase and in a Posttest, which was developed in order to estimate if the child still entertained the meaning that s/he had given to the novel term in the Test Phase and the way in which this particular lexical entry was reflected in the comprehension and production of the term.

The tests were designed to be used as an assessment tool for the child's understanding of the new word encountered in the story. These tests were concerned with a range of functions, so that the total testing profile would include the child's linguistic abilities (both comprehension and expression), verbal and imaginal coding, the child's general knowledge, and IQ. The tests in Experiment 1 were arranged in a certain order that was identical for all the children.

Standard testing, such as the Wechsler Intelligence Scale for Children (WISC), and the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) (Wechsler, 1949, 1967), show that a child often demonstrates great diversity in types of intelligence. A given child may score at age level in nonverbal measures such as, for example, sight discrimination, drawing and concept comprehension, but score 1.6 years younger or older on a language developmental scale like the Reynell tests. These qualitative variations in the tests in the experiment are part of their diagnostic value. The variation may, for example, identify highly restless children who might find Test 5, the drawing test, in which they are doing something with their hands, easier than Test 3, the category test in which they are required to sit still and give a verbal definition.

The scoring in the study was twofold; it entailed the scoring of the protocols gained during Encoding and the scoring of five different tests. Experiment 1 was based on similar work of other researchers such as Brown (1957), Werner and Kaplan (1950, 1952), Wykes and Johnson-Laird (1977). It is characteristic of all these studies that the scoring procedure is not described in detail and, in some cases, is not described at all. Several assumptions are therefore being made: a) that most experienced experimenters in the developmental field are familiar with the procedures of standard scoring as used in both standard language development tests such as Reynell (1977, 1983) and standard IQ tests such as the WISC and the WPPSI (Wechsler 1949, 1967) and the Stanford-Binet (Terman & Merrill 1960); b) that the scoring in their studies, instead of being subjective, is based on the standard procedure; c) that the order of presentation is important, in order to avoid errors that are not concerned with the aim of the tests; d) that all responses must be demonstrated in order to be scored; e) that 1 point is given for a correct answer and 0 points for wrong or no answer, and f) that suggestive questions should be avoided. Thus with the same standardised design, differences in scores could result from two main sources: the skill of the experimenter and/or the subject sample that is being investigated.

It is important to realise that all scoring is based on the experience and skill of the experimenter. Thus, the standard scoring is very strict and in the Encoding and the tests in Experiment 1, correct answers for each question are scored with 1 point and, in order for a correct answer to be scored, the instructions must be carried out by the child exactly as requested and without omissions. An attempt is made at finding a trend in the developmental data but not to calculate the scores in terms of a quotient.

As in any psychological test, scores alone have limited value. Thus, observational notes were made on the ways in which the individual child accomplishes individual tasks and what sort of mistakes s/he makes. I have based the scoring procedure for these tests, to a large extent, on Reynell's language developmental scales (1978). (See more about the scoring procedure for each test on p. 64-65).

Taken together, the quantitative scores and the qualitative data generated by the observational notes give a useful indication of the assets and difficulties in linguistic functioning, concept formation, and drawing abilities. These data are of value when the child's overall performance is being estimated, but they are also useful for specific information such as screening tests of linguistic abilities, which can be used to develop individualised educational programs for specific children. The aim is to gain a comprehensive testing picture.

A drawing test has been added to the end of the last test battery. Many studies have shown that drawings of children are influenced by general intellectual development, which include age and emotional development. Drawings of houses have, for example, been used to estimate or diagnose mental development (Krampen, 1991). It is known from these studies that the house drawings of 5-year-olds differ fundamentally from those of older children. Because the child's cognitive development assessments are not necessarily based on language, it is possible in Experiment 1 to better tap the understanding that young children or children of low linguistic abilities have for new words. The child's drawings should constitute an access to the mental images on which they have been based so that if these images are undifferentiated the drawing should be the same; if the images are clearly articulated, however, the drawing should be clear. It has been argued that in the earlier phases of graphic activity, drawing and writing are not yet separated; both are based on graphemes, the smallest graphic elements, which develop between the ages of 4 and 6 years. These graphemes are thought to constitute a sort of visual script that children use to note down their "internal models" on paper. Drawings of metal things in the test would originate from the child's mental image of metal things in the sample, or from experiences of things made of metal (Krampen, 1991).

Subjects.

In Experiment 1, the subjects ranged from 5 to 12 years of age and were all pupils of the Bridgend Primary School in Callander in Mid-Scotland. The experimental sample consisted of 160 children from Bridgend. Most of these children come from the town of Callander or from the nearby farms, and were relatively homogenous in their socio-economic background, coming from predominantly middle-class homes. All the children were native speakers of English. No systematic attempt was made beforehand at gaining information about the subjects' intellectual levels. The school's records showed that the school enjoyed an above-average performance on a standard Vocabulary Test of English, which has been demonstrated yearly with the oldest children, those in Primary 7.

The experimental sample was divided into four age groups, consisting of children from Primary 1, 3, 5, and 7 with equal number of boys and girls. The mean age for the groups were 4.9, 6.9, 9.1 and 11.2, referred to below as the 5-, 7-, 9-, and 11-year-old groups.

Materials and Procedure.

A story (See Table 2.1, p. 53) was read in six sections, each followed by an interval of a few minutes, during which time subjects were questioned about the preceding section. An unfamiliar mineral term, Mikas, appeared in six different verbal contexts or sentences within the story (See Table 2.2, p. 54, and Appendix A, p. A6-A9).

The story was presented to the subject in an ordinary schoolroom set aside for the purpose. A few days before this presentation the experimenter first visited each age group and told the children that she had written a science fiction story that she was going to invite them to watch on video and asked them if they were willing to help her by answering some questions about it. Teachers were given instructions not to allow the children to discuss the story and the experiment in the classroom after they had been tested, but the teachers knew little more than the children did about what was involved. The experimenter later met the children individually and again invited them to listen to a story and to help to answer some questions. They were then shown the video recording of a young woman reading the story that was written for the experiment. The unfamiliar term was deliberately made less than salient in the theme of the story, in order to test the verity of the assumption that selective, conscious attention need not necessarily be involved in the acquisition of a word and its meaning.

In summary, then, this recorded story presents the subjects with auditory and visual stimulation, the last one mentioned being a part of the non-linguistic context of the study. The story, per se, provided subjects with an indirect and implicit encounter with the natural kind term they were supposed to plot.

The experiment was designed so as to give children a series of quasi-natural contexts, each of which contributes something different to the sense or denotation of the word.

Encoding Phase.

One of three different methods were used to probe word knowledge during the Encoding Phase:

1) Indirect questioning: Experimental Condition 1 (E1).

2) Metalinguistic questioning: Experimental Condition 2 (E2).

3) Metalinguistic plus indirect questioning: Experimental Condition 3 (E3).

Each test session consisted of two phases: an Encoding Phase and a Test Phase. In all three conditions the subject's understanding of the stimulus word was probed by means of question instructions.

In three experimental conditions and one control condition subjects listened to the videotaped story for 5 minutes; then the tape was stopped and the subjects were asked questions, which varied according to experimental condition. After answering these questions, they listened to the next part of the story, then were interrupted and asked to watch the video again. Thus, each child completed:

a) an Encoding Phase, which took about 25 to 30 minutes to present and was broken into intervals giving scope for some manipulation on the novel lexical item; and

b) a Testing phase, which involved presenting the child with five tasks that had been designed to plot the subject's lexical entry for the novel word. This phase took place immediately after the Encoding Phase and lasted from 20 to 30 minutes.

Thus Experiment 1 took 45 to 60 minutes, the time varying a bit, mainly as a function of the subject's age.

A period of 6 to 8 weeks was allowed to pass until the child was presented with a Posttest involving two separate Test Phases aimed at estimating the child's comprehension and production of the newly acquired term and estimating the verity of the main hypothetical notion to which the experimental data had given rise.

This Posttest involved two Test Phases administered separately:

a) a Comprehension test, and

b) a Production test.

Each Test Phase took 5 to 10 minutes, and an interval of two days separated the comprehension and production portions.

Table 2.1.

An Example of Text from the Story.

Section 2

Skyfax is now out of our known galaxy and is soon entering a galaxy in the Milky Way no one from planet Earth has been to before. Soon Captain Cook gets planet Oc on the radar screen and starts to prepare for the landing. Everything seems to work out well. They land at the entrance to a big valley. As they leave the starship they take their helpful robot C-1B with them. When they start to look around, they see in the middle of the valley the ruins of what seems to have been an old city. The only building which is still in a reasonable state is a huge temple near some rocky hills above. Everything is deathly quiet. No animals, plants or life forms of any kind can be seen anywhere. Huge layers of sand lie all around. There is something glittering in the sand; it is Mikas which does not wear off easily. Suddenly their robot C-1B gets very excited and unfortunately stumbles over some ruins and falls forwards. He lies like this for a while complaining, but then gathers himself together and hurries towards the temple. What is his excitement all about?

(See the story in full length in Appendix A, p. A6-A9)

Table 2.2.

The Six Sentence Exposures of the Unknown Word Mikas in Experiment 1.

1) A good supply of Mikas supported the Oc's culture.

2) There is something glittering in the sand; it is Mikas which does not wear off easily.

3) Their voices echoed strangely in there because of all the Mikas in the hall.

4) Once out of the ruined city, they came to a countryside of many farm ruins circled by fences made of Mikas.

5) When out of the water, Cook's clothes were soaking whereas the Mikas he had kept in them from the temple was wet, but of course not soaking as it does not get soaked by water.

6) Captain Cook's hand brushed against something in the city ruins made of Mikas which the sun's rays had made terribly hot and burnt himself.

Experimental Condition 1.

In the Indirect condition, the subject was asked to select from a set of objects made of six different materials the one that the experimenter had named. In each interval the objects were spread on a desk in front of the subject and their position was haphazardly determined.

One of the six materials was supposed to represent the unfamiliar metal substance called as Mikas in the story. The other five substances were: leather, wood, felt, plastic, polystyrene. The unfamiliar metal referred to in the story as Mikas was represented by steel that had been painted a silverish metallic blue colour. When these steel objects had been painted, tiny brass flakes were sprinkled on them to make them look even less familiar.

The stimuli objects differed in shape, colour, and substance, and included objects like small buns (felt), spoons (Mikas), keys (Mikas), buttons (plastic, wood) as well as geometric shapes of circles (coins), crosses, stars, and cubes. There were six different colours used: red, green, yellow, blue, silver, pink. Three of the substances (leather, felt and polystyrene), were soft with smooth edges, and the other three, (plastic, wood and Mikas) were all hard with sharp edges. Only one of the substances was heavy and that was Mikas. There were felt squares, 60 x 60 mm; felt crosses, 100 x 100 mm; felt buns, 100 x 30 mm; Mikas crosses, 45 x 45 mm; Mikas stars, 55 x 55 mm; Mikas coins, 20 x 20 mm; Mikas coins, 15 x 15; Mikas spoons, 160 x 35 mm; leather crosses, 55 x 50 mm; leather stars, 60 x 60 mm; wooden stars, 60 x 60 mm; wooden crosses, 48 x 48 mm; wooden cubes, 30 x 20 mm; wooden buttons, 30 x 10 mm; plastic stars, 60 x 60 mm; plastic cubes, 30 x 20 mm; plastic crosses, 48 x 48 mm; plastic buttons, 15 x 15 mm; polystyrene crosses, 50 x 50 mm; polystyrene stars, 55 x 55 mm, and polystyrene coins, 20 x 20mm (See Photos 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, p. 57-59).

Objects were requested in a randomised order with questions such as: "Will you hand me over the Mikas ones, please?" or "Will you hand me over the leather ones?"

Subjects were allowed time to touch and observe the materials if they wanted to before being questioned about them. Because pilot testing had shown that a multiplicity of the objects tended to confuse the five-year-olds, only two items of each material were included in their presentation. All other subjects were shown three to four objects of the same material in a sample set at each presentation.

In the test sample the child was presented with somewhat unstructured alternatives. By varying the similarity of other materials in the sample to the target material (polystyrene, leather, felt, wood, and plastic), I hoped to be able to discover something about the range of similarity over which the child's inductions occurred. None of the materials was of the same category, and all were different in appearance. However some were more similar to Mikas than were others. The target material was the unfamiliar-looking metal, Mikas; the polystyrene and plastic materials both looked shiny; the polystyrene looked soft and light; the plastic was hard and not as light as the polystyrene. The leather, felt, and wood had a different, nonmetallic appearance.

The aim was to acquaint the subject with the materials and to see the inductions the subject made in the process of grouping. Also, by presenting subjects with this test sample and giving them the task of sorting the materials into piles ("the ones that go together") I was able to have the subject choose the criteria--a free-sorting technique that was adopted from Vygotsky's grouping study (1962) with blocks and unfamiliar names, and Miller's sorting study with words (1978). It was predicted that subjects would choose the criterion material, rather than shape or colour, for example, and they would not make many mistakes in their groupings. Thus, they would adhere to the criterion provided by the context and their own sensitivity. Miller had found that when presenting his subjects with a sample of words drawn from a dictionary and printed on small cards, the subjects sorted these words according to their own criteria; subjects clustered words of similar meaning, such as words for humans or living things instead of adhering to a trial-error sorting. The groups were created by normal intuitive standards that are in line with the standards of dictionaries.

Photo 2.1. Sample Set of Mikas Objects

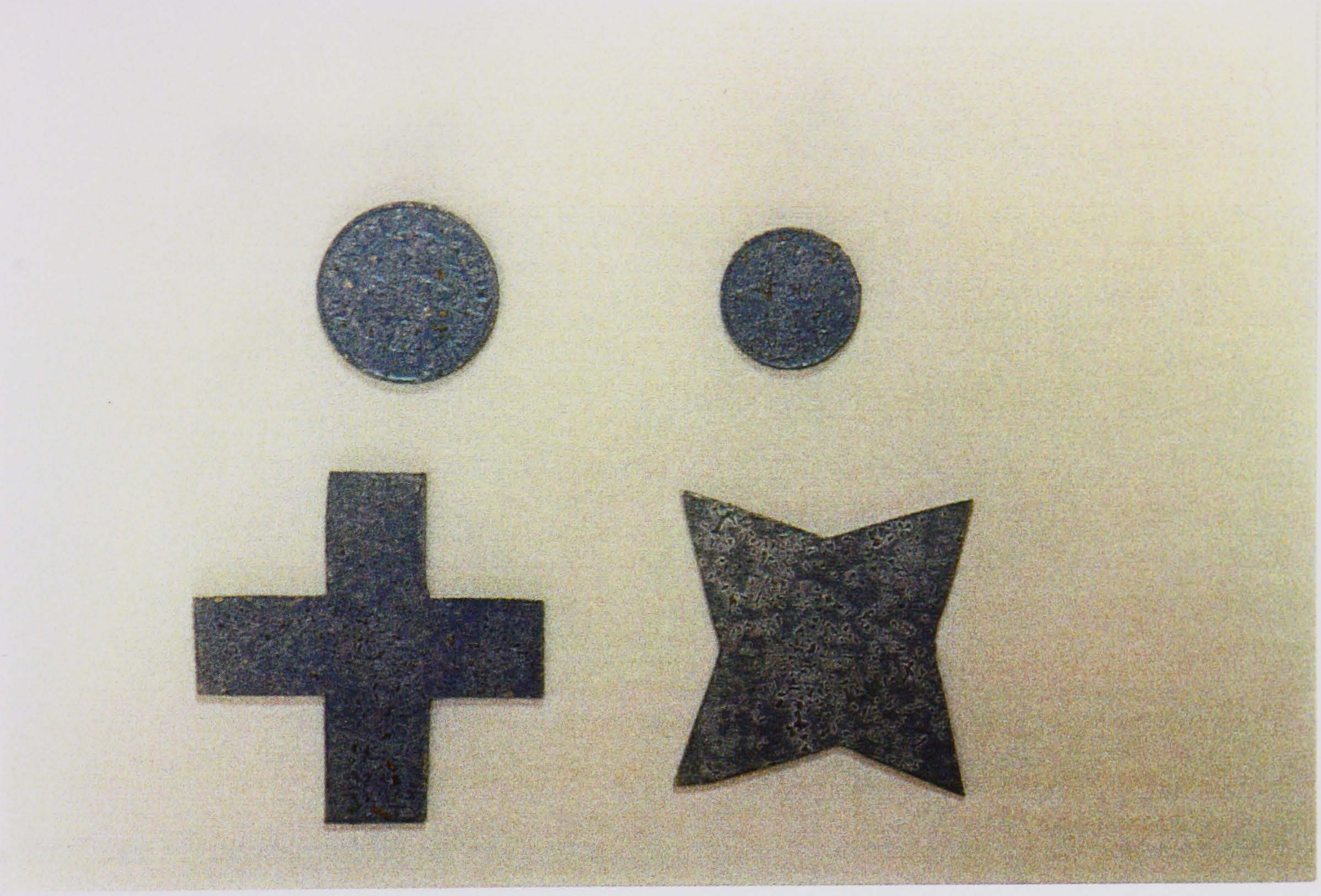
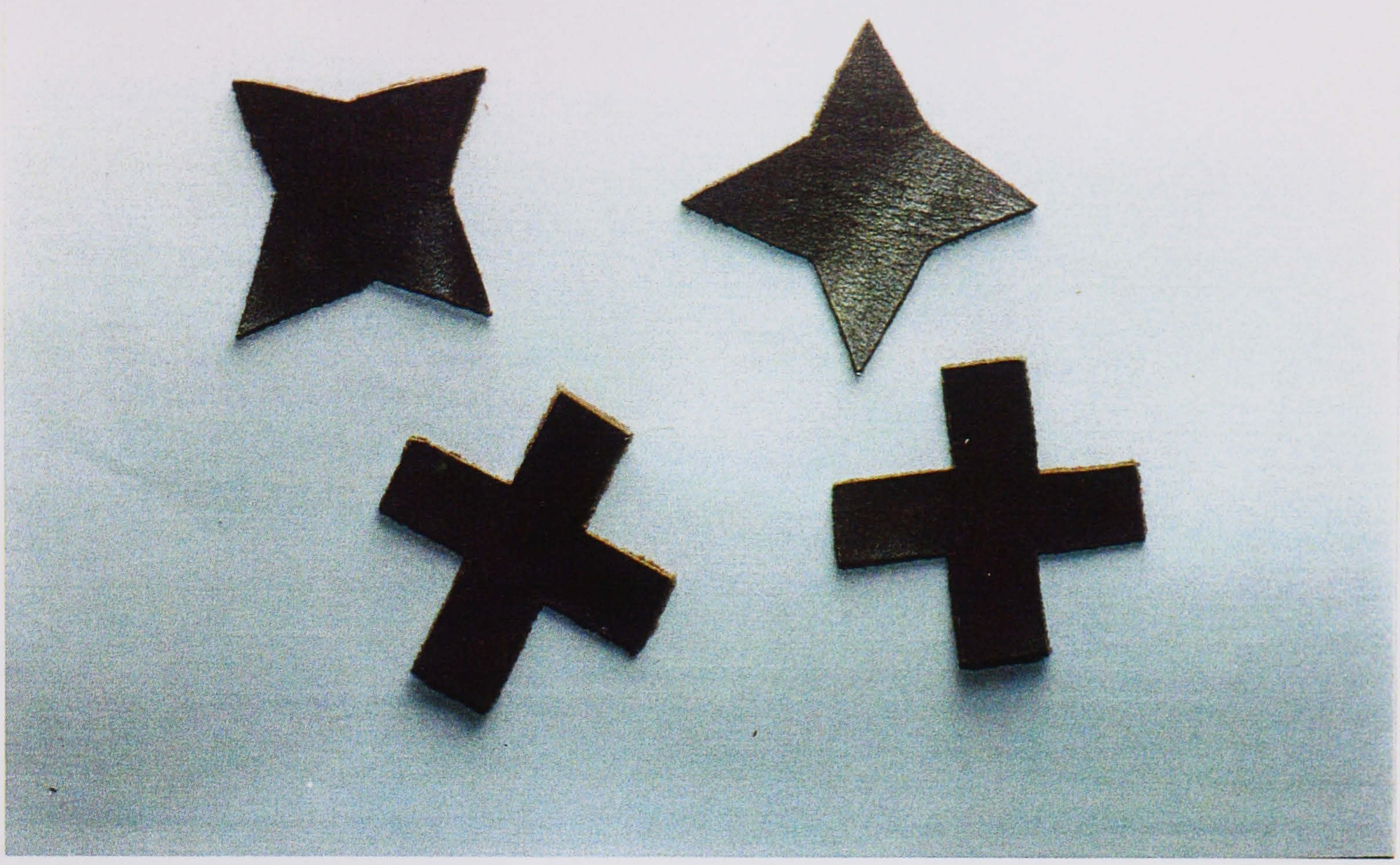


Photo 2.2. Sample Set of Polystyrene Objects

Photo 2.3. Sample Set of Leather Objects



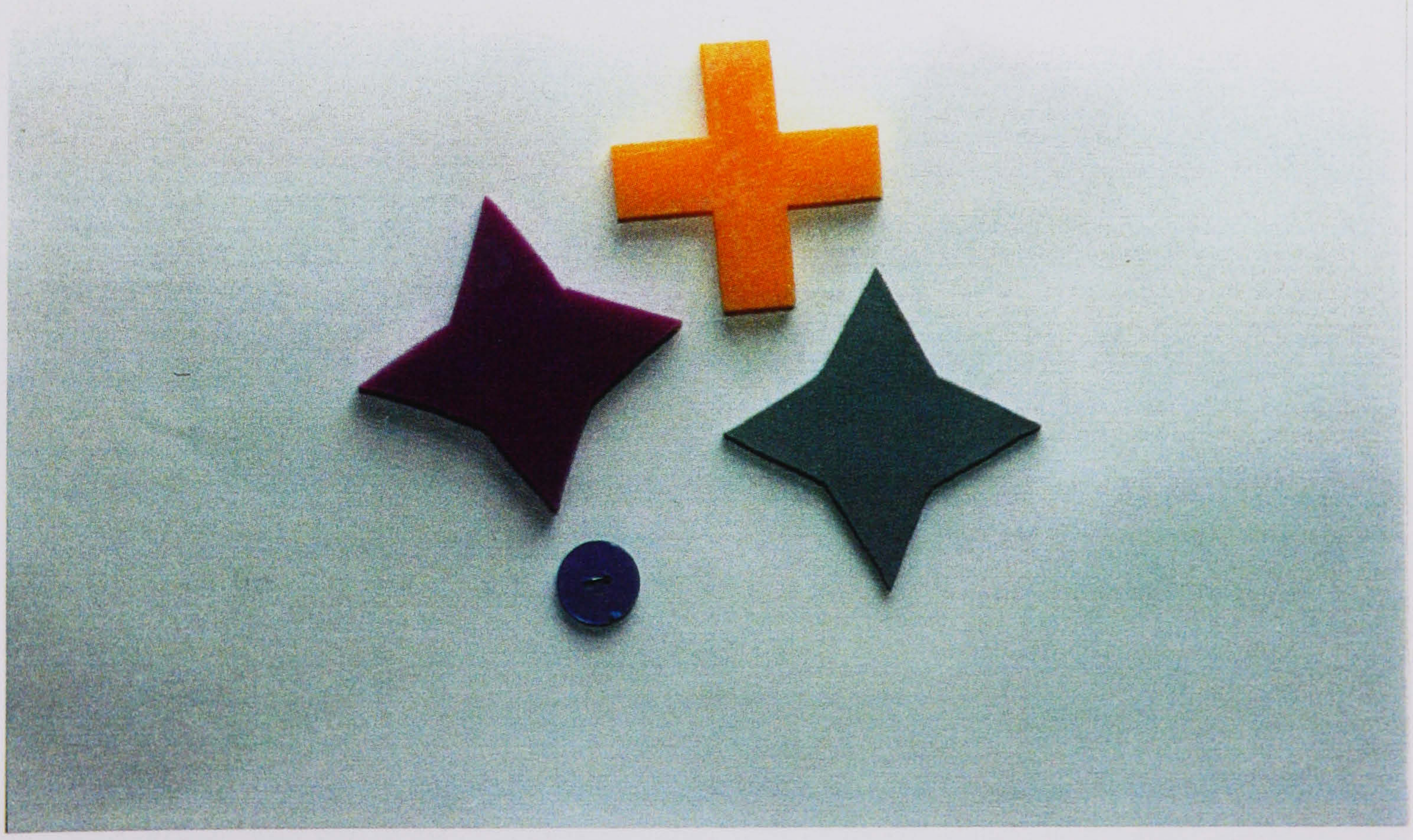
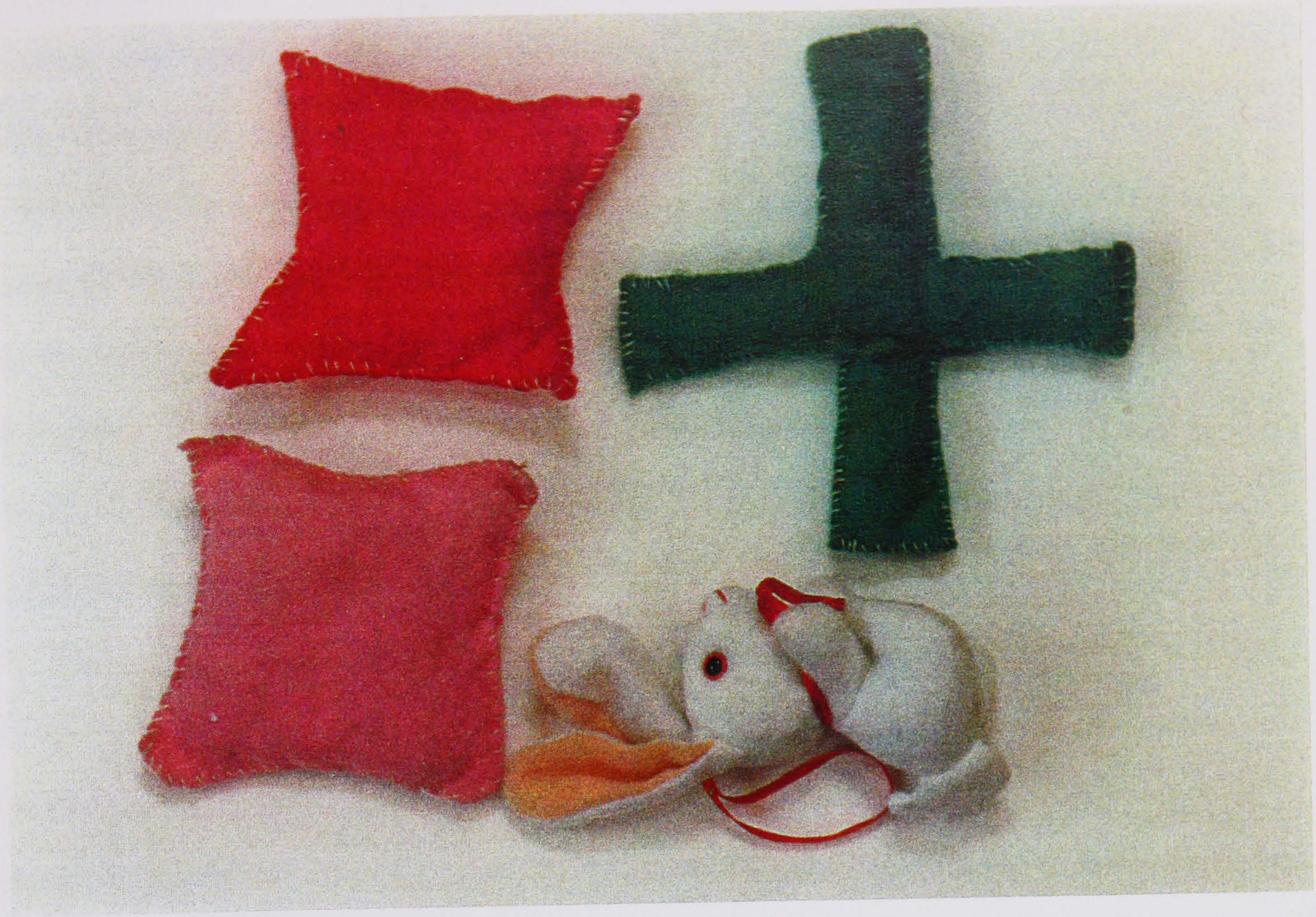


Photo 2.4. Sample Set of Plastic Objects

Photo 2.5. Sample Set of Felt Objects



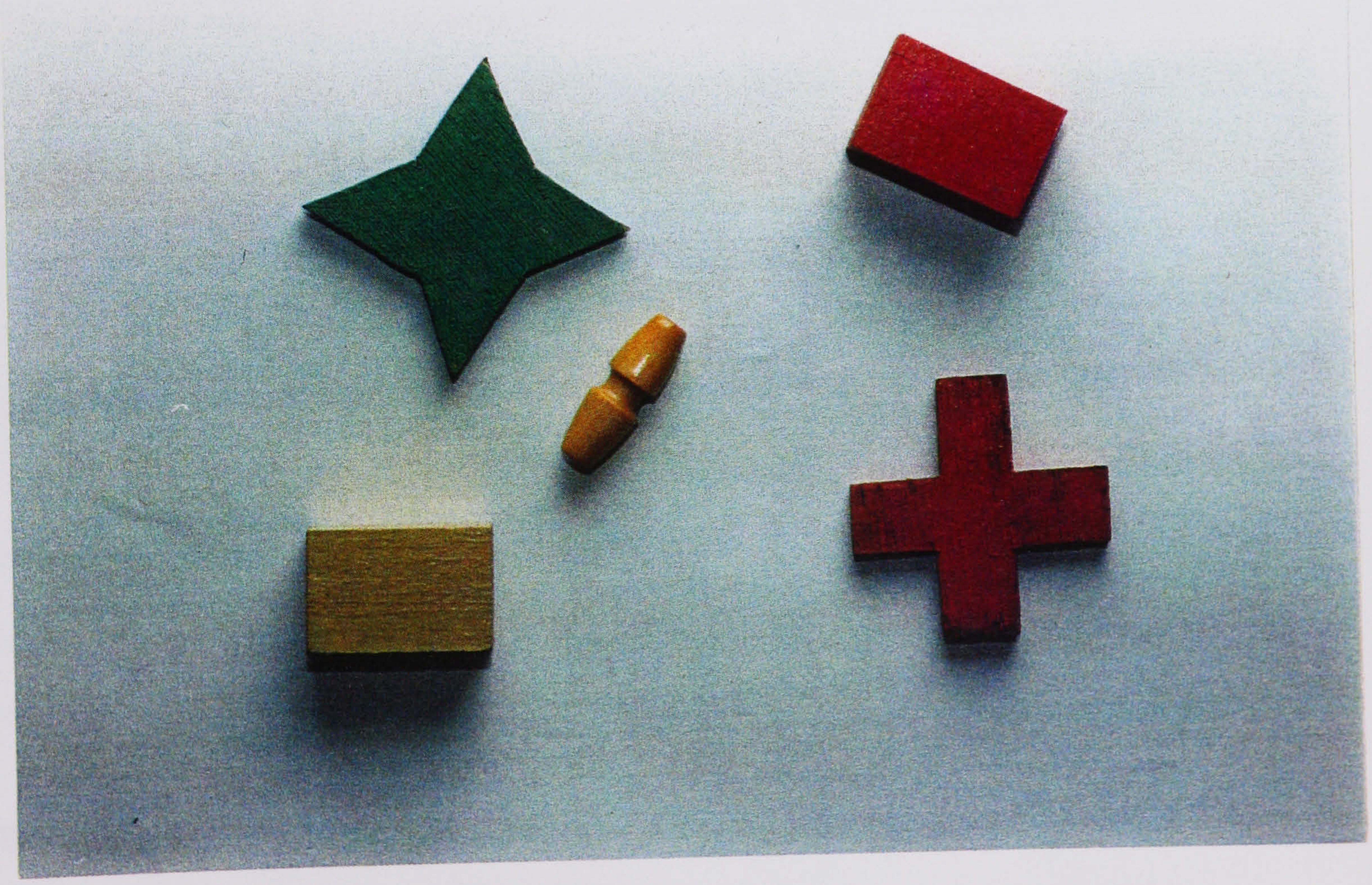


Photo 2.6. Sample Set of Wood Objects

Experimental Condition 2.

Subjects were asked to define six words in the story, each of which occurred once. These words were nouns, verbs, and adjectives.

In Section 1, the following questions were asked: "Do you know what the word 'destiny' means?" "Do you know what the word 'ancient' means?'" In Section 2: "Do you know what the word 'galaxy' means?" "Do you know what the words 'to stumble over' mean?" In Section 3: "Do you know what the words 'to bang together' mean?'" "Do you know what the words 'to contemplate on' mean?" In Section 4: "Do you know what the word 'decipherment' means?'" "Do you know what the word 'hieroglyphics' means?" In Section 5: "Do you know what the word 'satellite' means?" "Do you know what the word 'brainracking' means?" In Section 6: "Do you know what the word 'alien' means?" "Do you know what the words 'electric current' mean?"

In the Metalinguistic Condition, one of the words in each section was always "Mikas." Subjects in this condition were therefore asked six times about Mikas, but only once about each of the other words.

The subjects were asked if they knew what the word "Mikas" meant, if they had heard it in the story, and, if so, what they had heard or what they could remember about it. When subjects gave their definition of the novel term, "Mikas," they were asked to state the reasons for their definitions. They were also asked to compare their definitions of Mikas with the one or ones they had given at the earlier intervals of the story when asked about Mikas, and to state how well that definition would fit with their present definition.

Altogether, 80 children of the 160 subjects employed in the Encoding Phase of the experiment were presented with the Metalinguistic intervention procedure described above; these were the subjects in the two experimental groups named Metalinguistic and Metalinguistic Plus Indirect.

Experimental Condition 3.

In the Metalinguistic Plus Indirect condition, the subject was presented with a learning encounter that was a mixture of the procedures used in the Indirect condition and the Metalinguistic condition. In each story interval, the subject was first asked the metalinguistic questions and then presented with the test sample of objects. Subjects in Condition 3 had therefore had 18 encounters with the new term before the Test Phase started. This means that during the Encoding Phase they heard the new word six times in the linguistic context of the story; they were six times asked direct questions about the meaning and they were required to select a proper referent for it from a set of objects six times. When the Test Phase began after the story had ended, these subjects were familiar with the two types of task involved in it--namely Test 1 and Test 2. They had seen the test sample of objects six times before and were quite familiar with the six different materials used. Also they were familiar with direct questions about the novel lexical item.

Subjects in both Condition 1 and Condition 2 had had 12 encounters with the new term during the Encoding Phase--six times in the story encounter and six times in the interval encounter of experimental manipulation, including the sixth after the story ended with the last section.

The Control Condition

There were 40 subjects in the Control condition--ten subjects at each of the four age levels. After listening to each part of the story, these children were asked what was happening, who were the main characters in the story, and what was their role. In each interval, the children received five to six questions about the part to which they had just been listening and about the story's general theme.

The questions used in Section 1 were presented in the following manner: What was the purpose of the Skyfax team? Did you notice if others had attempted going to Oc? Did you notice if they knew something about the Ocs? In Section 2 they were asked: What was so special about planet Oc when they came? Did you notice that they had their robot with them? Where did they go next? In Section 3: Where did they come to when they followed their robot? What did they find there? How did they manage to enter the temple? In Section 4: Can you tell me what they found in the altar manuscripts? Have you heard about picture signs before? Could their robot translate these signs all by himself? In Section 5: How do you think captain Cook and his men felt on planet Oc? What did they find in the loch? So they got the satellite out of the water, how did they feel then? In Section 6: Can you now tell me just briefly what had happened to the Ocs? Why did the Ocs want to hide their secret knowledge? What did captain Cook think about the Ocs?

Pilot testing had shown the need to make the questions somewhat simpler for the younger subjects. By doing so the experimenter tried to encourage these young subjects to speak about the story at their level of understanding, hoping to get a picture of whether they had gained some global sense of the story. This precaution was taken because it had been predicted that the story text might be too complex for the youngest age group and the story too long, given the complexity added by the interval interfering procedure. Finally, children in the Control condition had no experience of the multiple choice set of objects or of questions aimed at estimating the child's mapping of the novel term; therefore children in this condition were unfamiliar with all the tasks in the Test Phase taking place after they had listened to the story.

The Test Phase.

The Test Phase was conducted shortly after the subject had listened to the entire story and been through the six stages of the story.

The subjects' performance in the Test Phase after the story was to be used as a criterion for their particular lexical entry for the novel term. It was predicted that the analytical or intentional learning procedure set up in the three different experimental conditions and the ambiguity inherent in the structure of these conditions would result in the subjects' "fast mappings," which again could lead to a more incomplete lexical entry for the new term. Age was thought to be a very important variable, however. The older subjects might benefit from this type of learning, their mental apparatus being ready for and used to sorting the criterial attributes of a given stimuli. Furthermore, their recall and recognition skills were better developed, along with their reasoning and general knowledge of the world, reflecting better developed communicative skills. In short, the older the children, the more likely they were expected to make use of the experimental setting in which they participated.

The five tasks were constructed around the mapping of the three components of meaning, which the "full meaning" paradigm to be used as a yardstick in analysing the acquired data involved. The definition of "full meaning" entailed that the child would know the sense and denotation of the novel lexical item and be able to make use of lexical knowledge in making an inductive reference about a proper referent within the range of possibilities given in the Test Phase situation. It was not thought to be the case, however, that once two components of the new word's meaning were known to the child, the third could be deduced in some calculative manner.

The Test Phase was conducted identically for all subjects and involved the presentation of five tasks, each presented singly to the child. The test sample that has been described earlier was used not only in the Encoding Phase of the experiment, but also in the real Test Phase that took place after the story had been listened to. The Test Phase involved five different tasks, and in two of them, Test 1 and Test 4, the same stimulus material had been employed in another context during the Encoding Phase with two of the experimental groups: Indirect and Metalinguistic Plus Indirect.

Test 1 in the Test Phase was actually the same sort of a multiple-choice task procedure with which these two groups were confronted in the Encoding Phase. This meant that half of the subjects in the total sample of 160 children, or 80 of them (40 x 2), were already familiar with the test materials and the nature of the first task in the Test Phase when they came to complete the Test Phase.

Test 1 (T1) : Object Comprehension.

In this first task the subject was presented with the same multiple choice set of objects made of the six materials that were used with subjects in Experimental Condition 1 and Experimental Condition 3 in the Encoding Phase of the study. (See p. 55 for a more detailed description of the set).

The perceptual and lexical contrasts that the child encountered in the task, although somewhat ambiguous, were thought to give the child scope to use the lexical knowledge already gained on the novel term in the Encoding Phase and to form the needed referential relationship between the different materials. However, none of the materials except Mikas was mentioned in the story. In order to establish the referential relationship, the subject had to comprehend which set of objects from all possible objects in the world the novel term denoted.

Subjects were asked questions such as: "Can you hand me the Mikas ones, please?" "Can you hand me the felt ones, please?" The order of the questions was randomised for all subjects.

Before the testing started, three or four objects of each material in the test sample were spread randomly on a desk and the children were allowed to handle and examine these objects. Thus, the children were able to familiarise themselves with the objects and to identify them perceptually before the test questions were asked. The experiment was not focused on how children sort things. Rather, by asking the child to sort the objects into piles without experimenter interference, it was hoped that the experimental situation was not too rigid and that it allowed the child's own interest in the objects to emerge. The objects were thought to be attractive to the child. By creating a short play situation as a prologue or introductory phase, and at the same time taking care that this play situation did not overwhelm the test situation so that the child failed to attend to the test instructions, or that it held up the test unduly, the experimenter could pinpoint the rules on the relation of the experimenter and the child that then went on all through the tests.

This procedure is based on Reynell (1977, 1983). Looking at the objects in response to the questions usually creates a selective response. The objects are requested randomly. For example, the experimenter would ask: "Can you now hand me over the Mikas ones?" "The plastic ones?" The child scored 1 point for each correct response. If a mixed response was given--let's say of both Mikas and polystyrene--the child was asked to point to or to show the Mikas by lifting it, a technique that is widely used in diagnostic tools of language development. In no case did the experimenter use a prompt such as "Are you sure?" or "Could it be something else?" The child was allowed to correct errors if s/he did it without prompting, as per standard testing practice. For example, the child might realise that s/he had not handed the Mikas objects as requested and could respond: "I realise I made a mistake earlier when I gave you the plastic ones; these are the Mikas." Such a response would be scored 1 point.

Test 2 (T2) : Category Definition.

Here the subject was presented with four cards, one at the time, and with one for each word. The words were all natural kind terms, animal term, plant term and the mineral term of the study. These words were used: rose, cow, Mikas, robin.

The subject was asked direct questions about the meanings of these words, "What does the word 'rose' mean?" "What does the word 'Mikas' mean?" or in the following manner: "What kind of a thing is a rose?" "What kind of a thing is Mikas?" Thus an attempt was made in a direct manner to determine if the child had established criteria to define the semantic domain of the novel term and its <u>sense relations</u> to other words.

In such metalinguistic questioning, the word is unaccompanied by objects made of the Mikas material and this requires a new orientation for the child. For the young children who were not expected to realise what was wanted of them, a prompt was allowed on the first word "rose," such as "What does the word rose mean?" and, if the child paused, s/he was asked "What is a rose?" If the child hesitated, the experimenter would ask, "What do you do with it?" "What do you use it for?" Children in both the Indirect and the Control conditions were not used to this type of questioning; whereas children in the two other conditions were. The language level needed for this type of questioning was thought to be higher than for the comprehension level of handing over objects as requested by their names, as in Test 1, so it can be argued that there is some contamination between Test 1 and Test 2.

It was expected that many young children would know what the new term, Mikas, meant, but would find this type of metalinguistic questioning difficult to answer and would find it difficult to explain their understanding. In this situation, the child has no perceptual cue, such as an object of a strange-looking material. The child had to describe an internalised concept from the internalised object/material/concept "Mikas" to the more abstract structure of relations. This test gives scope to assess knowledge of the word and ability to use expressive language to describe it. The test was so designed that the new word must be understood to be metal if the response was to be carried out correctly. For this reason, the scoring was very strict. If, for example, the child could only say "It's hard and shiny," or "It has got metallic bits on it." Mikas was scored as undergeneralisation. Similarly, by defining the rose, not as a plant, but as: "shaggy and has got leaves," the child would not gain a point. Even if the child said: "It looks like silver or gold," there could be no point scored without the demonstration that silver and gold are metals, as is the new material. Thus, the child had to demonstrate knowledge of the superordinate metal or mineral as Mikas in order to score a point.

Test 3 (T3) : Word-Sentence.

For this task, the subject was presented with a card with four artificial words, one of which was Mikas, the mineral term under the study. The other unfamiliar words were: Gombe, Patas, and Tapas. On the card there were also four sentences, two of which included a natural kind term, and two of which included an individual kind term, which, in both instances, were words that denoted objects made of metal. The four sentences were as follows:

1) You use it to sew with.
2) It can be used to make coins and pots.
3) You use it to drive in.
4) It can be used to make clothes.

When the subject was shown the card s/he was asked whether s/he had heard any of the words before. Then the child was asked to find a sentence to match the word chosen. Here an attempt was made to discover if the subject had developed proper <u>referential understanding</u> of the underlying conceptual category, and, on that basis, had developed the <u>sense relations</u> of the term, which helped restrict its <u>denotational boundaries</u>. Also, the subject was provided with an opportunity to recognise the new word within a productive frame of three other unfamiliar words, to which, to the experimenter's knowledge, the child had not been previously exposed.

In this case, the subject was requested to discriminate the word "Mikas" from a set of three unfamiliar-sounding words ("Gombe," "Patas," and "Tapas") and show clear understanding of the things, that the word "Mikas" denotes. Two of the things referred to in the sentences are actually objects made of metal: in Sentence 1, a needle (Gombe) and in

Sentence 3, a car (Patas). Two of them are materials: in Sentence 2, (Mikas) and in Sentence 4, wool or felt (Tapas). This test therefore taps the conceptual development of the child, the grasping of the constructional and functional aspects of the word in question, and its underlying conceptual structure. Being able to discriminate between a piece of metal and objects made of that metal requires the identification of categories of individual and kind concepts and appearances. Being able to discriminate between metal and wool, for example, requires the identification of both as kind concepts but of different categories within the hierarchy of material concepts.

Test 4 (T4) : Production.

Here the subject was presented with the same multiple-choice set of objects as in the first task and was asked to match objects made of the same material and to name the material. By comparing performance on this task with performance on Task 1, the experimenter could estimate the child's production of the novel term and whether there was a dissociation between comprehension and production. On this basis, it would be determined if the child knew the sense of the term and was in the process of delineating or had already delineated denotation.

As with all standardised tests, it was hoped that the experimenter would quickly become familiar with the usual range of productive responses, which would make it easy to understand what the child was saying even if the articulation was not 100% correct. Any sound recognisable as a true verbal label was acceptable. If the child always used the same sound sequence to refer to "Mikas" (like saying "majes" for Mikas), that was considered to be correct. Similarly, if the child left one item of the Mikas sample, like one coin, on the desk, and, having recognised this, and having said, for example, "And here is one more majes coin," that response would be scored as correct. It was felt that heavy demands on errorless speech were inappropriate, following the practice of Reynell (1977, 1983), who allows certain inexactness in articulation in her expressive tests. By adopting this less arbitrary method of scoring, I was attempting not to underscore the deserving child.

Test 5 (T5) : Depiction.

In order to map the child's understanding better and to appeal to the younger children's level of communicative understanding. I decided to include in the Test Phase a task in which the children were asked to draw something made of Mikas. Along with this task came a short interview, in which the child was asked where Mikas could be found and if s/he had heard about it before. The child was also asked to draw something made of wood and asked similar questions about. Then the child was asked how s/he liked the story and what it had been about.

The main rationale for using drawings in this test was to tap the child's understanding of the new term better. This strategy was particularly important for the younger children. An intermediary stage might exist between nonverbal and verbal understanding and at early stages a child's understanding is postulated. still. to be dependent upon circumstances and to be procedurally based. These tests such as Test 2. Category, that make more requirements for a declarative skill, are not suited to tap understanding at this young level. Generally speaking, the drawings were thought to give the children scope to represent to themselves and to the experimenter features present in the test sample or to draw on the source of earlier experiences of metallic things and imitations where graphic forms are used to represent internal models. Internal models or mental images have been stabilised by frequent internal imitation of perceptual activity (cf. Krampen, 1991).

I would argue that the child's drawings depend in their form largely on the maturation of inborn muscular and perceptual abilities. The youngest children in the experiment were 5 years of age. It is known that the forms produced by children of this age are often miniaturised or present the usual geometric shapes--circles, squares. or triangles--and that subdivision of these geometric shapes is further spontaneously exercised. By selecting geometrically shaped objects made of various materials, like the ones used in the testing sample, I hoped to ensure that children of all ages would be able to draw them. Also. as children are thought to build images gradually when allowed to explore an object, the touching and sorting of the objects in Test 1 and Test 4 was bound to influence the child's image or "motor copy."

Scoring in this case was based both on the drawings and the way in which they defined their drawings when asked about them. They were first asked what they had drawn and then asked questions such as "What is Mikas?" "Where can you find it?" "What can you use it for?"

If a cross or a circle was drawn, the child was asked what they were, if they were hard or soft, where the material could be found for these, and so on. These questions were designed to explore the conceptual mapping and to probe the child's answers in order to score the drawing properly. There were crosses and circles in the test sample of all the materials used.

Let's assume, for example, that the child has drawn something like a tin. The experimenter asks the child what s/he has drawn and s/he answers: "A tin." The experimenter asks the child what it is made of, and if the child answers "Mikas," or "metal," the drawing is scored as correct.

The Posttest.

In the Posttest the same setting was utilised as in the Encoding and Test Phase. The subjects were asked if they wanted to come again to the schoolroom to help the experimenter with some questions. Each subject was tested singly, but the Posttest was conducted identically for all subjects.

The Posttest took place six to eight weeks after the Word-Context Test and involved two Test Phases: a Comprehension Test and a Production Test. The intention of the Posttest construction was to estimate how well the subjects entertained the mapping of the novel lexical item that they had been supposed to plot in the experiment, and to see if there were any observed disassociations between comprehension and production. Also, I hoped to get some idea of the range of the subjects' vocabulary for mineral terms and the generalised hierarchical structure of that vocabulary.

The Posttest was presented by the linguistic context of a story which was approximately the same length as one section of the story used in the experiment. (See

story in Appendix A, p. A6-A9). The story's theme was somewhat similar too. In the story there were six words about which the subjects were asked directly after hearing the story. One of these words was the unfamiliar mineral term, "Mikas," of the former story. This term occurred twice in the Posttest story, but in the story the subjects were also exposed to a new term of the same semantic domain. This new mineral term was "Cobalt," which the subjects encountered twice in the new story.

The story and the metalinguistic questioning constitute the Comprehension Test. After answering questions about each word, subjects were asked to check how well they thought their definitions would fit into the sentence frame. In the case of the younger subjects, the sentences were read once again, if they gave no answer after one reading.

Subjects were not presented with a multiple-choice set of objects while the story was read aloud, except in the case of the very youngest age group. For this group the objects used in the experiment were spread on the desk before them and they were asked if they remembered having seen them before. Then the story was read aloud for them. If these youngest subjects could not give any answer on the meaning of the unfamiliar term "Mikas" in the Comprehension Test, they were again presented with the object sample and asked if they could point to the Mikas things.

In the Production Test, which was conducted separately two days later, subjects were asked to make a list of all the mineral terms they knew or could remember. Both these Test Phases took about five to ten minutes for each subject.

Results.

The following section describes the analysis of the experimental data. Quantitative analysis is described first, followed by qualitative/descriptive analysis.

A Quantitative Analysis of the Data.

The quantitative analysis of the data is based on calculations of the raw scores of point 1 for correct answers and point 0 for wrong, or no answers. Various statistical tests were run in order to arrive at the final analysis of the two main variables, Age and Intervention. These analyses were Chi Squares, t-tests (with means tables), Anovas, and the Duncan Multiple Ranges Test.

The analysis reveals that in Experiment 1, Age reaches significance levels for performance in all Tests, T1 to T5. It is clear that many subjects in all groups and conditions reach full mapping of the new term. The tests were designed to test for the sense, denotation, and reference of the new term. Age had largest effect on sense in the test Category ("What is Mikas?"), followed by Tests 3 (Word Sentence), Test 4 (Production), Test 1 (Object Comprehension), and lastly Test 5 (Depiction).

It is clear that after the subjects had been through the first four tests, the test of depicting yielded the highest score across all Ages and conditions. Tests 2 and 3 were similar tests; they both tested for sense and they did not give scores as high as Tests 1 and 5, both of which tested for denotata. The test of Production, in which the subjects were asked to name the referent, proved to be the one yielding the lowest score. This score was intercorrelated with the test for Production in the Posttest. There were, however, a few more subjects in the Production posttest that could not name the referent but could do so in the initial test. There was almost a one-to-one correlation between the first test and the first posttest, in which the test sample of objects made of different materials was used. Children in the experiment did better on tests of denotation than on sense, but in the latter instance they still scored above chance levels as a group.

Males did slightly better in most tests in Experiment 1 than did females. The whole experimental setup may have appealed more to the boys than to the girls, because the boys may have been more interested in the story of a space adventure and in objects made of metal.

The result section starts with tables showing characteristics of responses during the Encoding Phase, then patterns of within-children/between-children responses in the Test Phase are shown, followed by individual between-groups comparisons for the different tests together with a correlation matrix for the tests, and, finally, effects of age and condition on performance are presented.

Characteristics of Responses during Encoding.

The correct responses to the new term during Encoding are presented in the following tables (Tables 2.3, 2.4, and 2.5, p. 73) It should be stressed, however, that many subjects in all age groups did not attempt at giving a definition for the word. Here Category A means definitions of Mikas as metal without relating to something else outside the story by description or to some linguistic or nonlinguistic context within the story and the experimental setting; Category B means definitions of Mikas related to the story context by mentioning the word in relation to some part/parts of the sentential contexts or to part/parts of the story or to events in the story or to the experimental setting and Category C means definitions of Mikas related to something linguistic and/or nonlinguistic outside the story.

Table 2.3

Metalinguistic - Correct Responses during Encoding.

Section 1

Age	A	B	C
5	1		
7	1		
9	1		
11		1	

Section 6

Age	A	B	C	Test 1
5	4			3
7	2	2		6
9		1		7
11		4		8

N=40

Table 2.4.

Metalinguistic and Indirect - Correct Responses during Encoding

Section 1

Age	A	B	C
5	0		
7	0		
9	0		
11	2		

Section 6

Age	A	B	C	Test 1
5	1			6
7	5	3	2	9
9	1	6	3	10
11		6	3	10

Age	S1	S2	S3	S4	S5	S6	Test 1
5	2	4	5	4	5	6	6
7	6	8	10	10	10	10	10
9	3	6	8	10	10	10	10
11	2	8	9	10	10	10	10

N=40

Table 2.5.

Indirects - Correct Responses during Encoding.

Age	S1	S2	S3	S4	S5	S6	Test 1
5	0	4	2	1	2	2	3
7	4	6	5	6	6	5	7
9	3	8	9	10	10	10	10
11	6	10	10	9	10	10	10

N=40

(In all these tables, Test 1 means Test 1 from the Test Phase that takes place after the Encoding Phase).

Patterns of Within-Children/Between-Children Responses.

In order that the patterns of within-children/between-children responses can be estimated, their raw scores have been presented and have been calculated as the percentages of the possible total scores for each group, in which N = 10. Results from T1 (Object Comprehension, T4 (Production) and T5 (Depiction) have been presented in the following bar graphs (see p. 75-77). Results from each of the other tests in the Test Phase can be seen in Table A.1., p. A12, in Appendix A accompanied by bar graphs (Appendix A, Fig. A.3., Fig. A.4., p. A13-A14).

Figure 2.1.

Percentages of Correct Responses for Age and Condition.

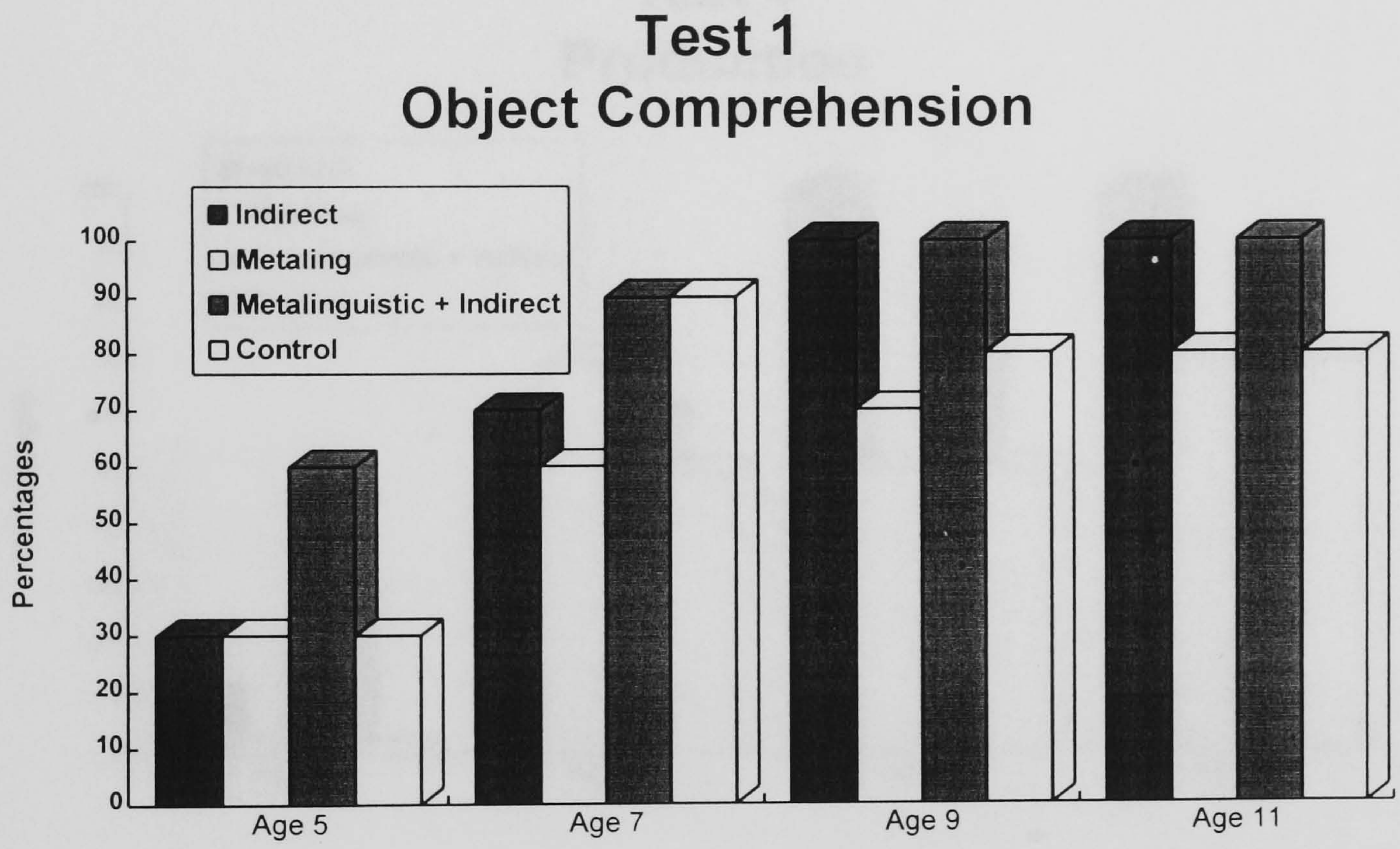


Figure 2.2.

Percentages of Correct Responses for Age and Condition.

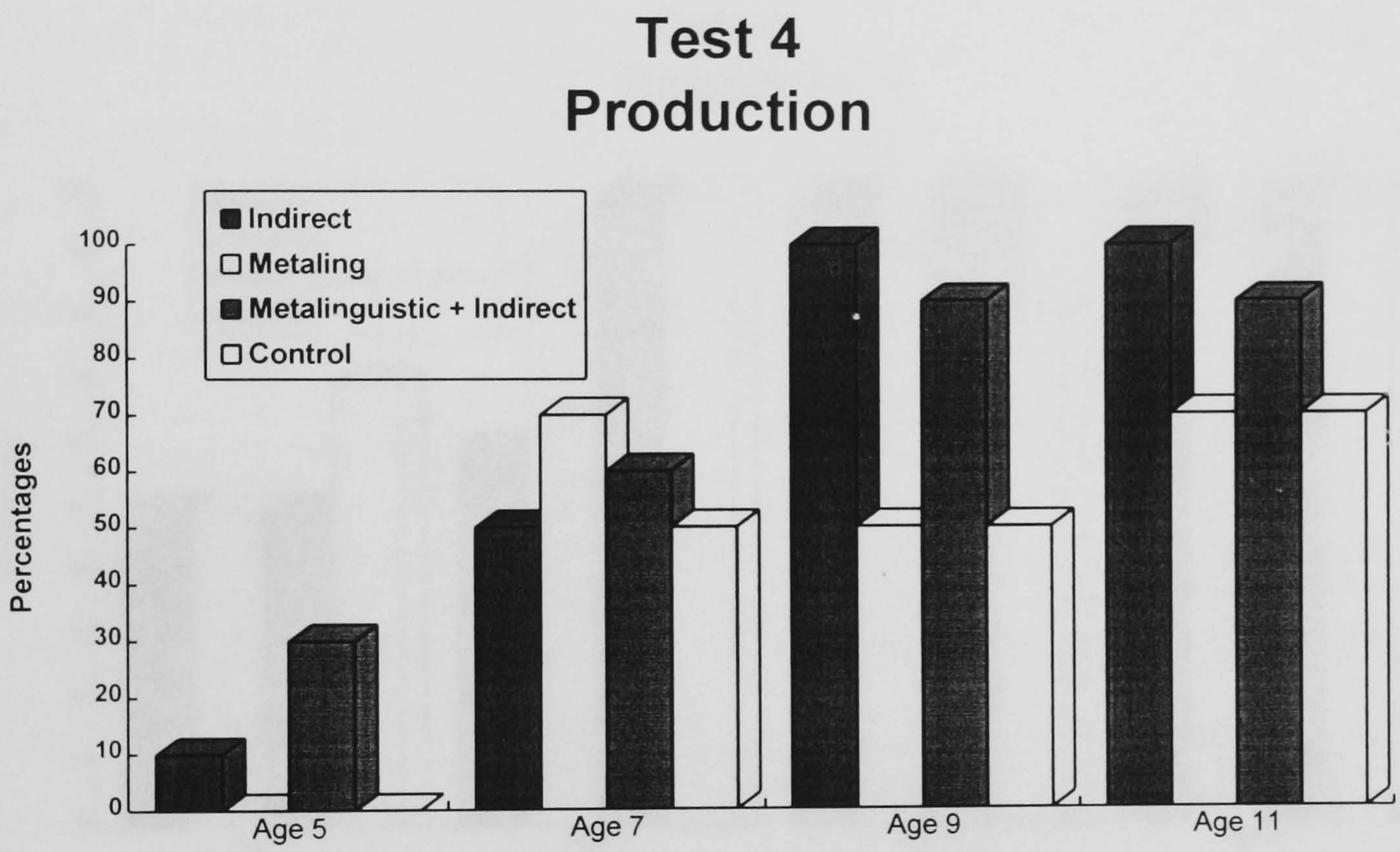
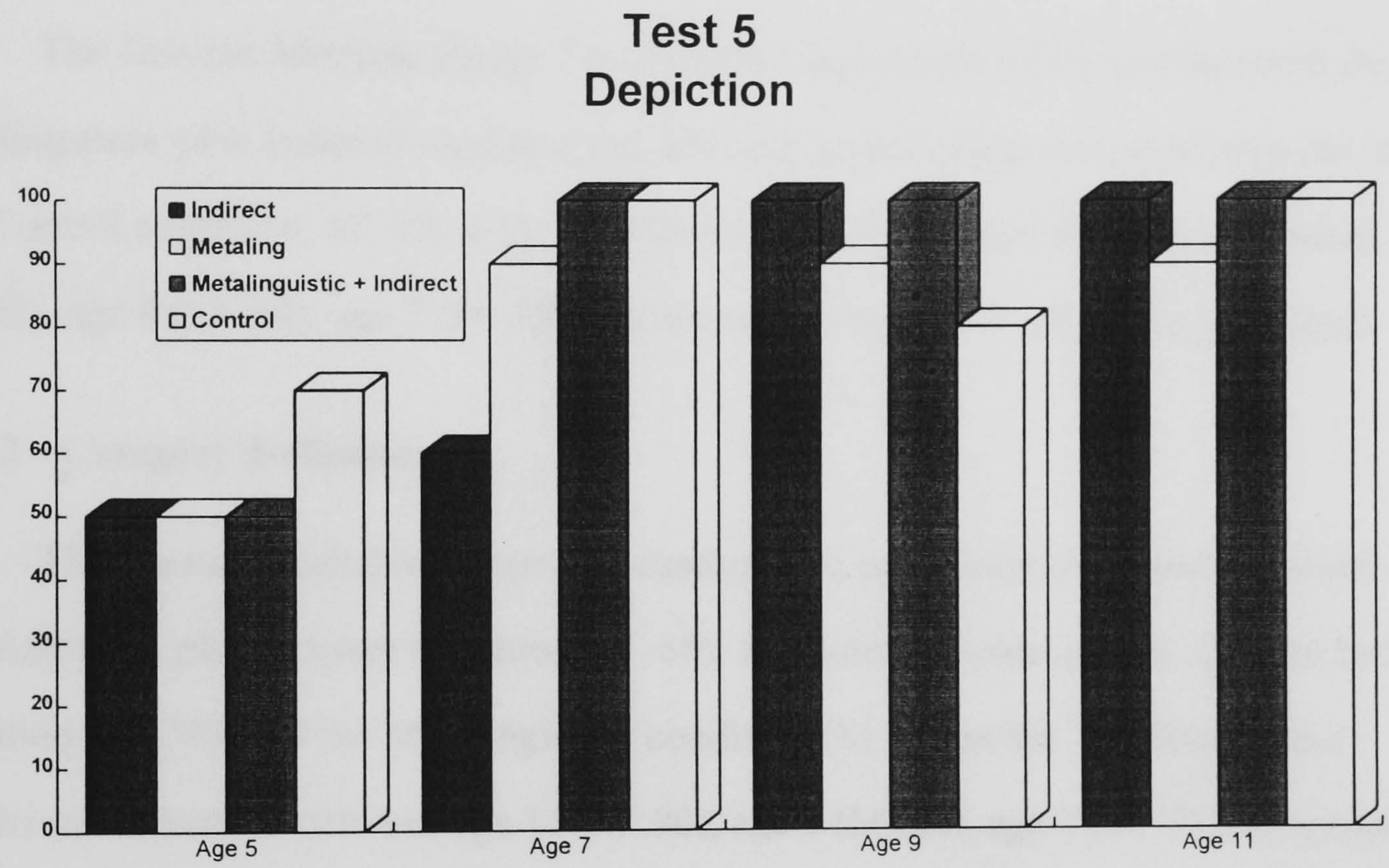


Figure 2.3.

Percentages of Correct Responses for Age and Condition.



Individual Between-Groups Comparisons for the Tests in the Test Phase.

The different tests reveal interesting age-related developmental variations in the sample, and the effects of different encoding procedures; by using individual between-groups comparisons, employing the Duncan Multiple Ranges Test, the significance in performance is confirmed between the conditions and between the ages for the various tests in the Test Phase.

Test 1 - Object Comprehension

The Duncan Multiple Range Test confirms significant difference between the Metalinguistic plus Indirect condition (M .88) and the Metalinguistic condition (M .60), (the Control condition, M .75) at the .050 level, and a significant difference between age 11 (M .92), age 9 (M .88), age 7 (M .78) as compared to age 5 (M .38) at the .050 level.

Test 2 - Category Definition

The Duncan Multiple Range Test confirms no significant difference between the Metalinguistic plus Indirect condition (M .68), the Control condition (M .67), the Indirect condition (M .58), and the Metalinguistic condition (M .56) at the .050 level, but a significant difference between age 11 (M .90), age 9 (M .80), age 7 (M .71), as compared to age 5 (M .10) at the .050 level.

Test 3 - Word Sentence

The Duncan Multiple Range Test confirms significant difference between the Metalinguistic plus Indirect condition (M .80) and the Metalinguistic condition (M .55) (the Control condition M .72, the Indirect condition M .60), at the .050 level, and a significant difference between age 11 (M .90), age 9 (M .88) and age 7 (M .68) as compared to age 5 (M .23) at the .050 level.

Test 4 - Production

The Duncan Multiple Range Test confirms significant difference between the Metalinguistic plus Indirect condition (M .68) and the Control condition (M .44) (the

Indirect condition M .65, the Metalinguistic condition M .48) at the .050 level, and a significant difference between age 11 (M .85), age 9 (M .73), age 7 (M .59) as compared to age 5 (M .10) at the .050 level.

Test 5 - Depiction

The Duncan Multiple Range Test confirms no significant difference between the Metalinguistic plus Indirect condition (M .88), the Control condition (M .88), the Metalinguistic condition (M .80) and the Indirect condition (M .78) at the .050 level, but a significant difference between age 11 (M .97), age 9 (M .93), age 7 (M .88) as compared to age 5 (M .55), at the .050 level.

(See Appendix A, Table A.2., p. A15 for subsets for condition and age for T1-T5 with the Duncan Multiple Range Test).

The following **correlation matrix** (Table 2.6, p.89) shows strong **correlation** *among some of the tests*: the strongest correlation of Test 2 (Category Definition) and Test 4 (Production) (.64**); then, among Test 2 (Category Definition) and Test 3 (Word Sentence) (.63**); among Test 3 (Word Sentence) and Test 4 (Production) (.58**); among Test 1 (Object Comprehension) and Test 4 (Production) (.56**); among Test 5 (Depiction) and Test 2 (Category Definiton) (.55**), and, finally, among Test 5 (Depiction) and of Test 1 (Object Comprehension) (.53**). (See more in Discussion on the revelations of the tests on p. 119-120).

Table 2.6

Correlation Matrix for the Tests in the Test Phase.

Correlations:	OBCOM	CATDEF	WOSEN	PROD	DEPIC
OBCOM	1.0000	.5942**	.4553**	.5619**	.5277**
CATDEF	.5942**	1.0000	.6343**	.6441**	.5472**
WOSEN	.4553**	.6343**	1.0000	.5839**	.4629**
PROD	.5619**	.6441**	.5839**	1.0000	.4773**
DEPIC	.5277**	.5472**	.4629**	.4773**	1.0000

N of cases: 160 2-tailed Signif: * - .01 ** - .001

Effects of Age and Condition on Performance.

The following are Two-way Analysis of Variance (Two-way Anova) showing effects of Age and Condition on performance in the different tests in the Test Phase. Anova tables and mean tables for these tests are presented in Appendix A, Table A.4. and Table A.5., p. A21-A29.

Test 1: Object Comprehension.

Two-way Anova shows significant main effects of Condition $F(3,144) = 3.55$, $p < .005$ and of Age $F(3,144) = 16.79$, $p < .001$. Age group 11.5 performed best overall, and all age groups performed best in the Metalinguistic and Indirect condition.

Test 2: Category Definition.

Two-way Anova shows significant main effects of Age F 3,144) = 35.59, $p < .001$. Age group 11.5 performed best overall, with the younger age groups performing best in the Metalinguistic and Indirect condition and the older age groups performing best in the Indirect condition but the younger ones having the poorest performance in the Indirect condition.

Test 3: Word Sentence.

Two-way Anova shows significant main effects of Condition $F(3,144) = 3.74$, $p < .05$ and of Age $F(3,144) = 26.75$, $p < .001$. Age group 11.5 performed best overall, with all age groups except age group 5.5 performing best in the Metalinguistic and Indirect condition. Age group 5.5 performed best in the Control condition. Age group 9.5 performed better in the Indirect condition than did age group 11.5.

Test 4: Production.

Two-way Anova shows significant main effects of Condition $F(3,144) = 3.65$, $p < .01$ and of Age $F(3,144) = 26.38$, $p < .001$. Age group 11.5 performed best overall, with the younger age groups performing best in the Metalinguistic and Indirect condition and the older age groups performing best in the Indirect condition.

Test 5: Depiction.

Two-way Anova shows significant main effects of Age $\underline{F}(3,144) = 12.99$, $\underline{p} < .001$. Age group 11.5 performed best overall, and all age groups performed best in the Metalinguistic and Indirect condition, except age group 5.5, which performed best in the Control condition.

Combined Tests.

The following are combined tests, the results of which have been calculated from the means of each of a given subtest (T1: Object Comprehension, T2: Category Definition, T3: Word Sentence, T4: Production, and T5: Depiction) in the Test Phase (see p. 63-69 for a full description of the tests). The results of two such combined tests are presented here. These tests have been named *Full Meaning* and *Comprehension.* It should be noted that the names of these combined tests indicate that in *Full Meaning*, a child who has all the subtests correct has worked out the full meaning of the new term as s/he has mastered both the comprehension and production of the new term; whereas a child who has one or more of the subtests wrong has only a partial meaning for the new term. In *Comprehension*, the test of Production (T4) has been omitted, and as the remaining four tests are testing for comprehension and a blend of linguistic and non-linguistic knowledge, a child who has all four of them correct can be granted with a general understanding of the new term and with some linguistic understanding--but not a full meaning yet--as s/he has difficulties in recalling it, a procedure that may be of a more semantic content than the one of *Comprehension.*

Full Meaning: All Subtests in Test Phase (T1+T2+T3+T4+T5).

Two-way Anova shows significant main effects of Condition $\underline{F}(3,144) = 3.43$, $\underline{p} < .05$ and of Age $\underline{F}(3,144) = 48.06$, $\underline{p} < .001$. Age group 11.5 performed best overall. Age group 9.5, performed best in the Indirect condition, whereas all other groups exhibited the best performance under the Metalinguistic and Indirect condition.

Comprehension: All Subtests except T3 for Production (T1+T2+T4+T5).

Two-way Anova shows significant main effects of Condition $\underline{F}(3,144) = 3.68$, $\underline{p} < .05$ and of Age $\underline{F}(3,144) = 44.70$, $\underline{p} < .001$. Age group 11.5 performed best overall. Age group 9.5, performed best in the Indirect condition, whereas all other groups exhibited the best performance under the Metalinguistic and Indirect condition.

The following graphs (Fig. 2.4., 2.5., 2.6., p. 84-86) present effects of age and condition on performance in T2 (Category), Full Meaning (T1+T2+T3+T4+T5) and Comprehension (T1+T2+T4+T5) .

Results from the posttests can be seen in Appendix A together with Anovas and mean tables for all tests in Test Phase and Posttesting.

Figure 2.4. Effects of Age and Condition on performance in T2, Category.

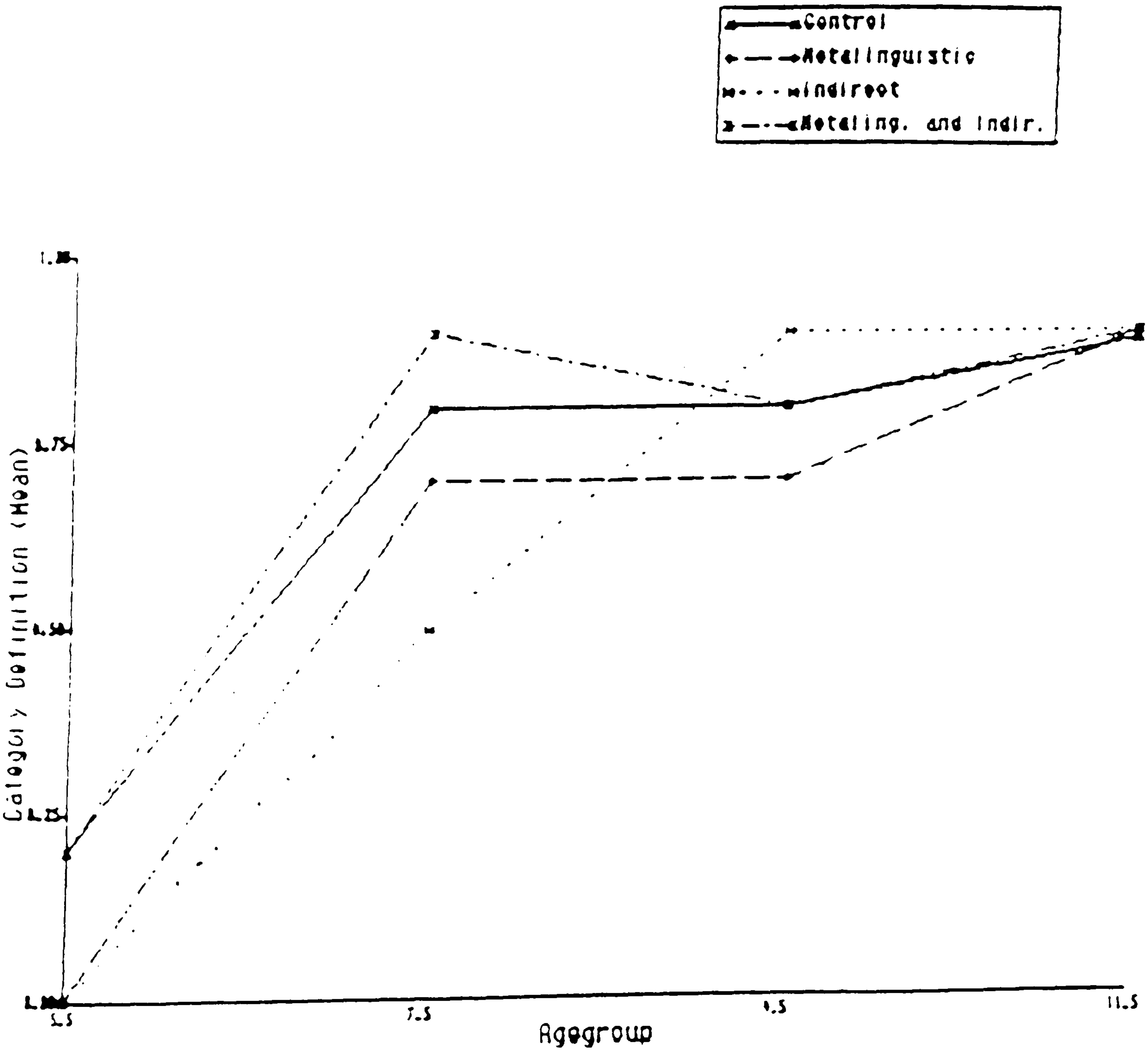


Figure 2.5. Effects of Age and Condition on performance in Full Meaning

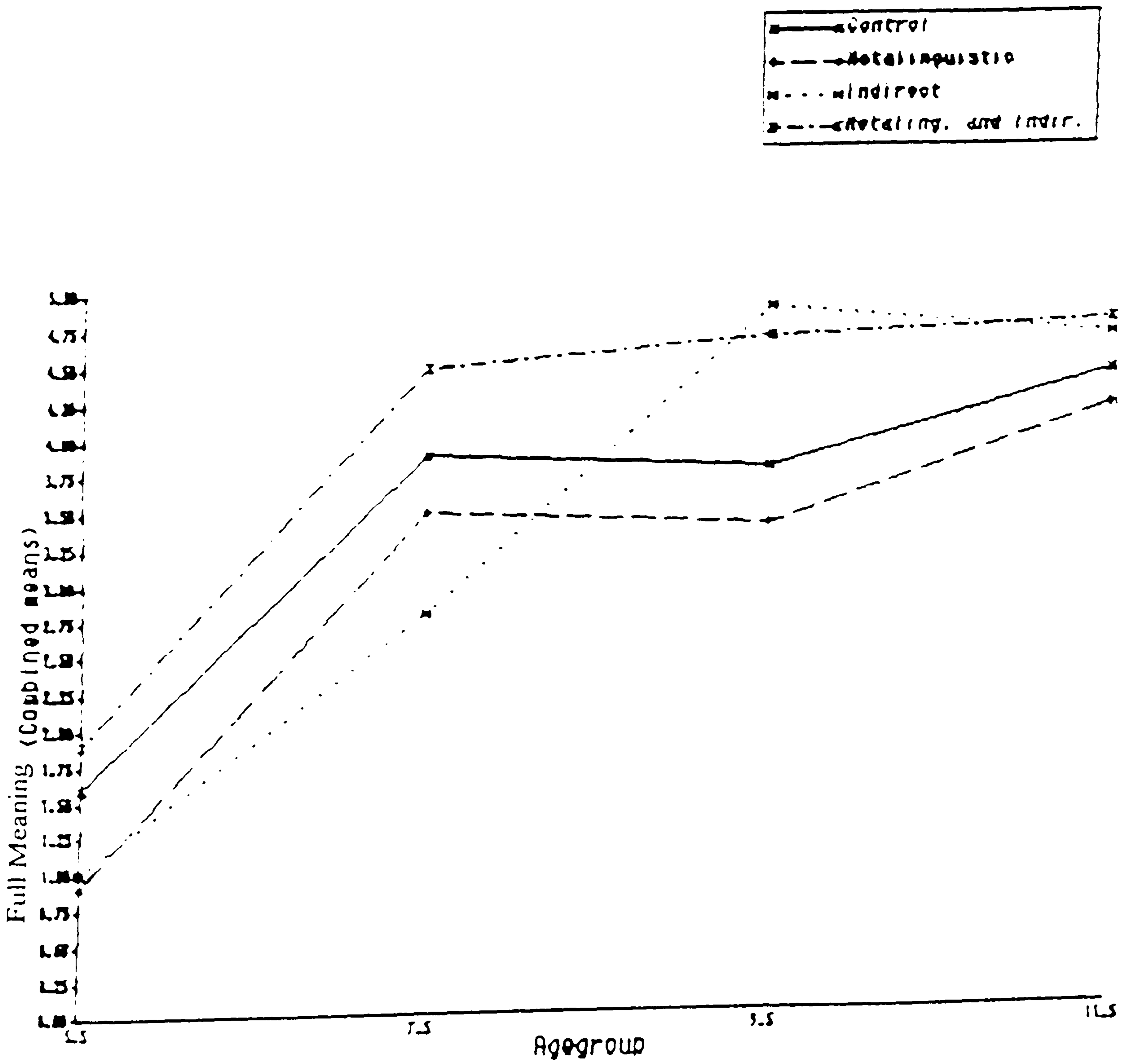
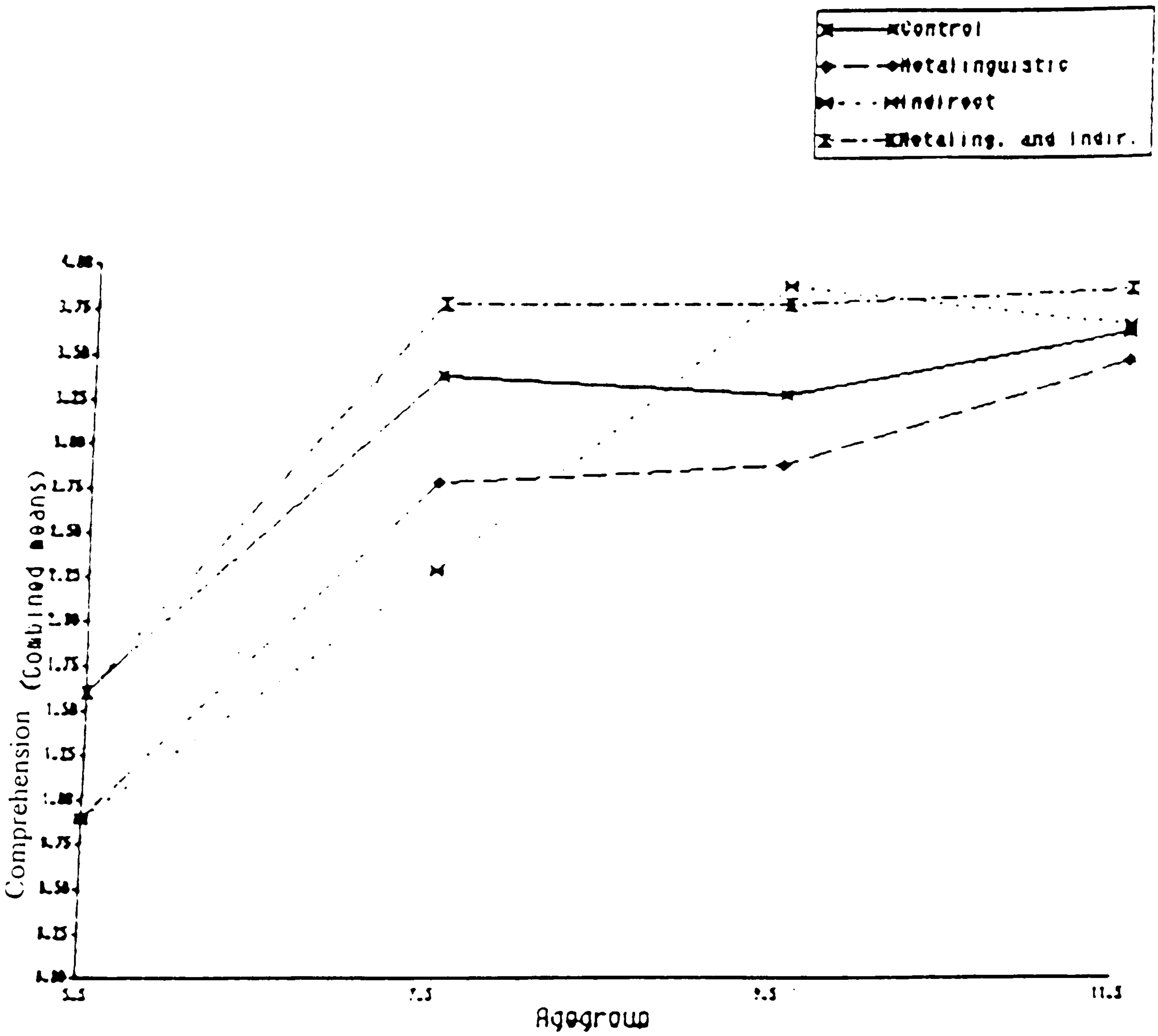


Figure 2.6. Effects of Age and Condition on performance in Comprehension



A Qualitative Analysis of the Data.

The qualitative analysis is based on the two main variables under consideration in the study: Age and Intervention. This analysis is descriptive as to the ways in which different types of encoding have emerged in the decodings for the new term both in Encoding and Test Phase. The analysis is based upon tape recordings and observational notes that were written down incidentally during the course of the study. The pragmatic factor in the study is established in the different types of encoding that each group underwent. This communicative context gave the background for which the new term was encoded and decoded and this was predicted to play a decisive role in the effect of ambiguity for the deciphering of the new term's meaning in the structure of the given situation.

The child's vocabulary and understanding of syntax are not sufficient to account for successful encoding or decoding of the new term; the child also needs to understand the communication situation itself. As stated in Krampen, (1991), Von Uexküll argued in the twenties for the totality of the child's perception, thinking, and action. He maintains that one should not concentrate exclusively on the question of perception or storing incoming information on the one hand or on problems of action and production on the other. Rather, all these processes must be seen together in a "function circle" (Krampen, 1991, p. 28).

If Joos's thesis holds, then, children with strong contextual abilities would decipher possible meanings for an unknown word in situations in which they know the meaning of the context--that meaning that would contribute least to or change least the total context. Joos contends that there are often discrepancies between one's reading of language and sense impressions from the real world, but he states that these discrepancies often seem, in the long run, to form a pattern themselves and that, when realising that, one corrects one's language. He calls this phenomenon intuitive behaviour that is not logical; one has to argue here by means of analogy. His ideas of intuitive behaviour and use of analogy or heuristics are similar to those of Werner (1952).

Werner (1948, 1950, 1952) had argued that there is a primordial form of classification of objects and experiences that is a primitive form of concept formation and involves a process of, linked to the emotions and sensations of the perceiver. This is a perceptual process that he has termed physiognomic perception and is itself non-specific and does not differentiate among the many phenomena it subsumes. He has stated that the primitive concept is not specific and stable but relative and shifting and that the object-subject relation is less sharply articulated: the physiognomic and dynamic qualities of things would stand out clearly, whereas abstract concepts would tend to a high stability and specificity.

It appears from the present study that children in all conditions have the strength of their own linguistic skill, past knowledge, and perceptual sensitivity to overcome the ambiguities in the input, and via their natural heuristics, are able to map the meaning of the new term. I hope the following descriptions will strengthen this assumption to a greater extent.

The Indirect Condition.

Two children in the 5-year-old group chose Mikas correctly in the sections, although some did get the hang of it, but slipped back. Children of the youngest age group showed a rather passive attitude towards the objects in the test sample. As a rule, they did not start to play with the objects, touch them, or examine them, except when encouraged to do so.

The six materials used were: wood, leather, felt, plastic, polystyrene, and Mikas. A few of the youngest subjects were not sure whether they were supposed to discriminate among the objects on the basis of shapes, colour, or material, but most of them seemed to entertain some notion of the conceptual domain covered by these exemplars and that the six terms denoted, in all cases, some sort of a substance. Many of them could not discriminate among polystyrene, Mikas, and felt, and experienced a good deal of confusion and trial-and-error sorting in the 6 Encoding Test Phases. They quite often gave the response of "polystyrene" for "Mikas" and vice verse.

Children of the 7-year age group behaved radically different from the 5-year-olds in their approach in the test sample to the objects with which they were presented. They seemed to be more active and more spontaneous, played with the objects, and examined them without encouragement. The following is an example of Indirect testing with John (6.9):

Section 1.

Takes rather a quick look at the things.

"Wood." Gives "Mikas."

"Plastic." Gives it correctly

"Mikas." Gives "Leather."

"Polystyrene." Gives it correctly

"Felt." Gives it correctly

"Leather." Gives wood

Section 2.

Looks carefully at all the things on his desk before giving them over.

Mikas

Leather

Plastic

Wood

Polystyrene

Felt

All correct.

Section 3.

Leather

Polystyrene

Mikas

Felt

Plastic

Wood

Section 4.

Mikas

Felt

Plastic

Polystyrene

Leather

Wood

Section 5.

Felt

Polystyrene

Plastic

Mikas

Leather

Wood

Section 6.

Polystyrene

Mikas

Felt

Plastic

Leather

Wood

Test 1.

Felt. Mikas. Plastic. Wood. Polystyrene. Leather

Test 2.

It's a flower and it's red.

It's in the field and it has got four legs and it gives milk.

E: Mettile.

It's a little bird with a red breast.

Test 3.

Reads the words. Says he knows Mikas and sentence 2.

Test 4.

Plastic

Wood

Polystyrene

Felt

Leather

Mettile

E: Do you know the name of this mettile?

S: Mikas.

Test 5.

E: Can you maybe draw me something made of Mikas?

S: Draws a key.

E: Where can you expect to find Mikas?

S: In a cutlery drawer.

E: Did you notice it in the story?

S: Yes.

E: Did they have Mikas on planet Oc?

S: Yes.

E: Do you remember what you heard about Mikas in the story?

S: Pause. "Did they find it in the loch?" he then asks.

E: What did you find most interesting in the story?

S: When they found it in the loch.

E: Can you maybe draw me something made of wood?

S: Draws a desk.

E: Where would you find the wood for the desk?

S: In a factory.

Posttests.

Test 1. Comprehension.

Mikas: Metal

Cobalt: A galaxy

A geologist: Scientist

Wee: Very small

Distant: Far away

To improve: To do better

Test 2. Production.

Gold

Brass

Mekas

Silver

Bronze

Carack Gold

Generally characteristic of the 7-year-olds' behaviour, was their dynamism and eagerness to participate in the task. They often thought aloud and used much facial expression and body language when answering. Usually, they knew most of the materials, but still some of them became confused over felt, polystyrene, and Mikas. When thinking aloud they gave remarks like, "This is polystyrene; then this must be Mikas."

They tried to check the experimenter on their responding and looked at her for approval, disapproval, or reassurance. Thus, their attempt at making a reasonable inference about the objects were more systematic and sophisticated. The children in this group seemed to be more relaxed, in that sense their type of task seemed to be easier than the one in the Metalinguistic Condition.

Nine-year-old subjects seemed to be confident and relaxed when presented with the test sample. Some of them examined the objects carefully at first--the edges, their weight and texture--while others just took a quick look at them before handing them over. The task seemed rather easy for them to solve and they made few errors, except perhaps in the first two intervals. They seemed to be able to correct themselves. The errors in responding centred mainly on polystyrene and Mikas and felt. These subjects did not think aloud as much as the 7-year-olds did, nor did they use as much body language or as many facial expressions when thinking and answering.

The 11-year-old children usually took only a quick look at the objects in the test sample before returning them and this they did with ease. Errors in responding were rare. They had greater knowledge of the materials and a considerably more sophisticated reasoning. It was common for them in the first section, when first asked to hand over Mikas, to say with surprise: "What?" Most of the 11-year-olds made mistakes only in the first section, if they made any mistakes at all. Usually, if they made an error in the first section, it was to say "plastic" or "polystyrene" instead of "Mikas." The oldest subjects looked at the edges of the objects and weighed them with their hands, a gesture that the youngest age group rarely made. The children were aware of the task demands. The demand characteristics of the task were plain to many of the 11-year-old children; they knew that the experimenter was interested in materials.

In order to do the task required for this study, a child must learn that an object can be referred to in more than one way. A cat can, for example, be referred to as "cat," "Rufus," "animal;" a metal can, for example, be referred to as "metal," "Mikas," or "mineral." If the child has more than one unknown material in the sample, s/he must choose between these for the unknown term. In the noun case, such as in Experiment 1, the expression always referred to a material; there was no doubt about it being some substance. Dockrell argues that:

> If an unknown phonemic sequence is heard, whose reference is made clear because of the linguistic elements which accompany it or because of non-verbal information, the child will look for an unknown object; if no such object exists the child will have to adopt an alternative strategy (1981, p.

124-125).

If they failed to identify the unknown referent by use of the linguistic information available, the younger children opted for a close alternative like polystyrene, which is unknown; knowing the name of the intended referent interferes with choosing an unknown but potentially appropriate alternative. The Mikas materials may have been more familiar-looking to them than were the polystyrene ones. Children of the age of those in this experiment, even the youngest ones, have fairly well-developed lexicons and the size of their lexicons are increasing rapidly (cf. Carey, 1978a). A strategy of pre-emption would therefore have been a useful way for them to limit alternatives. The situation with the Indirect subjects was, to some extent, structured by the question "Can you hand me the X?" This type of question helped them to set up a semantic frame. The presence of objects made of different materials helped the older children in establishing reference and hence in developing subsequent meaning. For the younger subjects, more unknown materials or material names were clearly more of a confusion to them.

Subjects in this experiment had two good reasons not to expect the new word to refer to a material that they knew by name: the child's own strategies for word learning and the lack of any linguistic information that would indicate that a change in level of analysis was required. Interpretation of this known/unknown dichotomy was expected to vary among children and situations as well as the child's degree of certainty about the real word. Katz, Baker, and Macnamara (1974) illustrated that the nature of the object is of significance in such situations. The supporting objects for the different materials used in the experiment indicated some definite referents and the level of specificity was in some sense determined; thus, the type of the referents were not specified any further. The children most likely assumed that there was a level of specificity used and that the context would support or question their initial assumption about this. I tried to assess the subjects' inferences concerning the referent of a new term and postulated that the context and intended level of specificity would be in harmony, conforming to the normal requirements of conversation, so that the level of specificity indicated by the universe of discourse and the intended referent would be the same. The intended referent was explicit, but the children were asked about it indirectly. It was physically present. This procedure presents the Indirects with information adequate to identify more than one intended denotatum if other referents in the sample are unknown.

The children isolated and incorporated features of the object or substance that they regarded as being critical in their representation of the term, saying, for example, "It is hard," or "It cannot get soaked." Children clearly used this information when asked why they thought that Mikas is metal. Children can clearly use contrastive information in a restricted referential situation in order to grasp the denotation of a new term when the other referents are known as often is the case with the older subjects in this condition.

There are also cases in which the child knows the intended referent exactly, even after giving an initial wrong response, makes a note of this, and spontaneously corrects him- or herself. Unless the initial referential relationship is established, no subsequent representation of the new term can be developed (Anglin, 1977).

The Metalinguistic Condition.

The youngest subjects, the 5-year-olds often seemed puzzled at the metalinguistic questioning with which they were bombarded during the intervals of the Encoding Phase. Often they seemed to want to say something but remained silent. They were very sincere and made a great deal of effort in trying to do their best. When they were presented with the test sample of objects in the Test Phase after the story, they seemed relieved. As regards the novel lexical item, Mikas, they made few guesses and shifts. They remembered hearing it, but could not state what they had heard. There were great individual differences in their definitions of words. They were very pragmatic in their answers and in their definitions of words and often related their definitions to descriptions of events that they had heard about in the story, or knew from experience. Some showed a great deal of interest in the story. It was common for these youngest subjects not to attempt any definitions of Mikas, or of any other words, whether they thought they had heard the word or not. The children who showed the greatest recall of the story also had the largest vocabularies. It is clear that they made greater effort when asked how their definitions of Mikas connected to each other.

The 7-year-old subjects clearly had more advanced memory skills (recognition and recall abilities) than did the 5-year-olds, and could remember more about Mikas from the story. They also tried their best to answer questions about all the words they were asked about in the Intervals, and gave them definitions for them, however incomplete. These definitions were strongly related to actions. These subjects became a bit tense and nervous when they were bombarded with questions about words and confronted to make a conscious effort to define their meanings. They had often heard the word "Mikas" in the story, but there were gross individual differences in recall. Some of them were able to make gradual shifts on the meaning of the new words, and most of them understood that the word denoted some sort of substance.

One child thought that Mikas was a Mecano after hearing in the story of Mikas in the hall, but after last section said "sun got it hot," and after fifth section, "bit of wall" and then corrected the information in the end by saying "It's metal, it sounds like it."

There was much better recall from story in the 7-year age group, but it is doubtful if they connected information from each section into a whole.

A general characteristic of the 9-year-old group was that these subjects seemed to make conscious demands on themselves and were not as spontaneous as the 7-year-olds. They seemed to be more cautious and greater metacognition was seemingly involved. The shifts in meaning that they made concerning the novel lexical item in question were not common, but those who did make shifts did not necessarily stick to their first meaning. Those who did stick to their first meaning tended to repeat their error in the Test Phase also. The following is an example of Metalinguistic testing with Jane (8.8):

Section 1.

E: Do you know what the word "destiny" means?

S: No, don't know.

E: Do you know what the word "ancient" means?

S: It's from long ago.

E: Do you know what the word "lifestyle" means?

S: The way you dress.

E: Do you know what the word "Mikas" means?

S: No, don't know.

Section 2.

E: Do you know what the word "galaxy" means?

S: Another planet.

E: Do you know what the word "robot" means?

S: A sort like human, but it is metal and it does what its master commands.

E: Did you hear the word "Mikas" now?

S: Yes, I heard it.

E: What do you think that word means?

S: Was it a human?

E: Why do you think so?

S: Just thought so.

E: Do you know what the words "to stumble over" mean?

S: To destroy it.

E: Do you know what the word "radar" means?

S. Pause.

E: A radar screen. Do you know where you can find radar screens?

S: In other planets.

E: What can they be used for?

S: Something that shows other people what is happening.

Section 3.

E: Do you know what the words "to bang together" mean?

S: A sort of hitting them together.

E: Do you know what the words "to contemplate on something" mean?

S: No don't know.

E: Do you know what the word "manuscript" means?

S: A piece of paper with an old writing on it. Heard the word in the story.

E: Do you know what the word "Mikas" means?

S: Yes. I heard it in the story now.

E: What do you think it means?

S: A sort of a place.

E: Why do you think so?

S: Pause.

E. Now you think it is a place and before you thought it was a human, can you tell me more what you are thinking?

S: No. (Looks a bit puzzled.)

E: Do you know what the word "fate" means?

S: You can rely on someone.

E: Faith, you mean?

S: Yes.

E: But fate, like "the fate of the Ocs?"

S: No. (Shakes her head).

Section 4.

E: Do you know what the word "decipherment" means?

S: No, don't know.

E: Did you hear that word in the story?

S: Yes.

E: Do you know what the word "hieroglyphics" means?

S: No, don't know, don't think I heard it.

E: Do you know what the word "Mikas" means?

S: Heard it now in the story.

E: What do you think Mikas means?

S: Stone, she says quickly.

E: Why do you think so?

S: Because they said the building was made of Mikas.

E: You said before that it could be a human or a place, didn't you?

S: Yes.

E: What do you think it was then?

S: A stone also. Is it a ruin? she then asks.

Section 5.

E: Did you hear the word "Mikas" in the story now?

S: Heard it in the story, she says and smiles.

E: What did you hear?

S: It said that Mikas didn't get wet in water.

E: So what do you think it is?

S: Plastic.

E: Why do you think so?

S: Because plastic doesn't get wet very often.

E: Do you think that the building could have been made of plastic?

S: It could have because greenhouses are made of plastic.

E: But this human you were thinking about first, what about plastic then?

S: No.

E: Can you find a definition that fits in with all the others, human, place, building, stone, plastic?

S: God, (makes a funny face).

E: But what about a "sort of a place"?

S: Heaven.

E: Do you know what the word "satellite" means?

S: A planet from orbit.

E: Do you know what the word "soaking" means?

S: Wet.

E: Do you know what the word "brainracking" means?

S: Thinking.

E: Do you know what the word "to nod" means?

S: You don't do it. You are supposed not to.

E: You mean in the classroom?

S: Yes.

Section 6.

E: Do you know what the word "electric" means?

S: No.

E: But "electricity?"

S: Things that you can use by plug to watch or for heating. You have to pay bills for them.

E: Do you know what the word "alien" means?

S: It's a sort of a baby robot, something like that. Comes from out of space.

E: Did you hear the word "Mikas" now?

S: No, never heard it in this section.

E: What do you think "Mikas" means?

S: Material, she says and looks at E.

E: Remember what you thought earlier that Mikas meant: "a human," "a sort of a place," "stone," "plastic." Can you tell me more about what you are thinking?

S: Don't think these first definitions were right.

E: Why do you think so?

S: God is not made of stone. Heaven is not made of plastic. A human can get wet easily.

E: Now you think Mikas is some sort of a material. Do you think you could find one definition that goes for all the other definitions?

S: No.

Test 1.

Picks up the objects to have a quick look at them before asked to hand them over.

Wood

Leather, (gives it with the wood).

Mikas, (first was going to give felt, but then changed her mind and gave Mikas).

Felt

Polystyrene

Plastic

Test 2.

A flower

An animal

Metal (Looked at the experimenter as she said the word. She sounded as if she was first going to say plastic).

A bird

Test 3.

Reads the words. Then picks up Mikas and matches correctly.

Test 4.

Understands straight away what to do.

Plastic.

Felt.

Wood, (was going to group leather with the wooden objects, then stops, leaves the leather out and feels these objects for a while).

Leather

Polystyrene

Mikas, (said this confidently).

Test 5.

E: Can you now draw me something made of Mikas?

S: Draws a pot.

E: Where can you expect to find Mikas?

S: In the kitchen.

E: You mean like pots?

S: Yeah.

E: But where does it first come from?

S: From a factory.

E: Do you think this is a man-made material or can it be found in nature?

S: In nature.

E: Whereabouts?

S: In mines.

E: Can you also draw me something made of wood?

S: Draws a tree.

E: What did you like best in the story?

S: When they landed on the planet.

Posttests.

Test 1. Comprehension.

Mikas: Metal.

Cobalt: Plastic.

A geologist: People who study.

Wee: Little.

Distant: Far away.

To improve: Do better.

Test 2. Production.

Mikas

Brass

Iron

Copper

Corrugated Iron

The 9-year-olds still tended to define words in terms of the use of the objects to which the words refer and the function of the word in the linguistic community. Their definitions were also rare in terms of synonyms. When asked to state their reasons for giving a special definition for Mikas, they often answered: "I just think so." Their word definitions still showed that they had, in general, greater knowledge than the 7- and 5-year-olds, and a better developed vocabulary.

Subjects in the 11-year-old group answered almost all questions about the words correctly and did so with relative ease. They made many shifts on the meaning of Mikas and these shifts showed greater flexibility of thinking and a more sophisticated reasoning than did the shifts made by any of the younger subjects. They were more willing to state their reasons for giving a particular meaning to the new term; they remembered more of the linguistic context that interfered with the lexical entry of the new word; and often, after hearing the first two or three sections of the story in the Encoding Phase, they came up with proper mapping for the novel term. Their definitions showed a trend towards a more sophisticated, declarative understanding.

They did not spontaneously connect earlier information with later information, but made many individual guesses. It is clear that subjects in this group with generally good recall of the story were also equipped with good vocabularies and had enough confidence in their linguistic intuition to overcome the ambiguity of the experimental setting. These oldest subjects clearly had improved auditory skills for processing language.

Following are examples of correct entries in the 11-year-old age group: "Mikas in hall made sound;" "Their voices echoed because of it;" "A type of dust, walls made of it, stone or rock;" "Does not get soaking wet;" "Sun got it hot and burnt him; must be rock or metal;" "Glittering, shiny in the hall and the sand, on the fences; must be metal;" "Got very hot, burnt him; it must be metal."

Subjects in this condition appeared to treat each sentence as a discrete entity. Or were the children unable to make the logical leaps? Did they not realise what was required? Or did the task itself inhibit the treatment of each sentence as an independent unit? Werner and Kaplan (1950, 1954) speak of incomplete final solutions; they say that their results reflect a young child's lack of recognition of the necessity for integrating, with a single solution, the cues offered by all six sentences. There are cases in which the subject's response is congruent for the presented sentence but totally incongruent with the previous presentation. There are other cases in which the child gave a correct response for the second sentence that would be correct and congruent for the third sentence, but then changed his or her response.

Some responses were coloured and dominated by the child's own private experience. Such response patterns suggested that the child had a preferred response and was unable to use responses already given. There were cases in which the child initially gave a correct response for the term, yet in following sentences responded "don't know" and then in the final sentence, was again correct. There were cases in which s/he responded with "don't know" for the first sentences and the last one and gave an incorrect in between. There were cases in which a series of correct congruent responses were tied directly to the sentence given, but the child did not integrate the individual solutions into one overall correct solution. Perhaps the amount of information given in that particular sentence was leading to a correct identification of the intended referent but not to a reflection of the child's ability to co-ordinate the information presented in a series of isolated sentences.

Let us look, for example, at Ana, age 11.2. When her answers to Mikas were probed, she showed this pattern: Section 1: "I don't know what that word means." Section 2: "Is it some sort of a chemical?" "There was something in the ground, hard to get off." Section 3: "Is it a sort of metal?" Section 4: "Some sort of building material." Section 5: It must be metal; it doesn't get soaking wet." Section 6: "It must be metal because he burnt his hand."

The preceding is a systematic development, with each response being appropriate for the preceding sentence as well as the present one. It shows that the child progressively develops correct meaning of the word, taking into account the information presented in each section. Most subjects, however, treated each sentence as a separate entity. In reality, the child must associate a number of independent presentations in order to grasp the meaning of a term. There was great value to the information gained by examining the single responses given by the metalinguistics.

In the Metalinguistic group during encoding the subjects often reported memories of instances of the new concept by saying, for example, "it's shiny and hard," "looks like silver." Here the particular aspects seemed to play an important role. The subjects did not consciously try to connect the information; they remembered particular things that served as contextual determiners or pointers but working out the general rule for categorising the new term seems to take place unconsciously. Joos (1967) argues that much language processing is automatic, and that the codes we use in language operate subconsciously-- that there is some "unaware familiarity" on the part of the hearer, and that the hearer is aware only of the product of the subconscious.

Some of the information that the children in this experiment gave for single responses is similar to that given by much younger children. Contextual associations for the development of meanings for the subjects that are procedural in nature are difficult to co-ordinate. The children used information from their own cognitive framework and from the linguistic information presented in order to arrive at an initial reference and a stable denotation of the new term.

In the Metalinguistic condition, a simple verbal definition left the option open for the child simply to say "don't know," and this response occurred often.

There were cases in which the children had problems accepting the fact that an object for which they already had a name could have another name. In these cases the new term was preempted; for example "Mikas" became "silver." Some children correctly identified the intended referent but rather than accepting, for example, that Mikas is a metal substance, they replied that "it's like gold; it's silver." It is possible that this was a refusal to accept that Mikas could be some metal other than the two metals known, or to accept that it is a mineral substance.

There were cases in which there were spurious justifications like "Mikas cannot be metal 'cause it looks like plastic." It is as if the child rejected the possibility of having two separate labels for the same entity. Clearly, this was also a time-saving strategy.

Interpreting the natural kind, the new material, Mikas, as an inanimate thing was rare among the children's guesses. Also they had a strong sense for Mikas as a natural kind concept, even if they were not able to give the proper definition. Children were less likely to give multi-word responses to nouns. There was little evidence, when the nature of the metalinguistic responses is examined, that the child was treating the word as a functional entity in its own right; rather, the attempts were focused on the broad context, on the procedures in which the word had been used or linked to. The child's attempts were of a global nature, undertaken in order to make sense of the situation. in order to provide the child with information. There was a lack on the child's part to treat the word in a declarative manner, as an independent, symbolic system, and to reflect on the logical relationships that hold between words within the lexicon. There were cases in which attempts were made to give information adequate to define the word. In such a response the child may have used information given in one sentence to define the word, or may have used the new term in a different sentence, suggesting that s/he had achieved some understanding of the intended denotation. The child may also have used the general sense of the sentence in order to derive a representation when repeating the word, after recognising that the information was relevant to an understanding of the new term. There were cases in which the child defined the term as an entity rather than as an association with other situations, such as saying that Mikas is a metal, without relating to the context of the story. Some words are more easily placed in novel contexts than are others. Some of the defining criteria presented in the target sentences are more appropriate than others, such as "glittering in the sand," in Section 2 in the story used in this study.

Despite these problems with the task, children did, in single responses, provide definitions (responses) that suggested that they were using sources of information, as a child in a natural situation would do. They were able to draw on their own experiences and upon the linguistic information presented in the sentences in order to gain some representation of the term.

The Metalinguistic and Indirect Condition.

Most subjects in the 5-year-old group realised that Mikas was a noun and many realised that it was a substance. A few realised that it was a metal substance. They often gave definitions of words with the contextual information of the story, or their experiential context such as defining "to discover." Their answers were linked to the context in which they previously had heard the word "moon." Even if they realised that Mikas is a substance, given all the information that they gleaned from the objects, they gave interpretations like "felt" or "plastic," "fences made of plastic." A few totally wrong answers were heard, like "a thing," "a kangaroo," "a shape."

Subjects in the 7-year-old group often said that they had heard the word in the story, but often didn't remember in what context. Yet they often give a proper definition for the word, and sometimes remembered hearing it in the latter sections of the story. When asked why they thought that Mikas is a metal, they sometimes referred to the objects they had been given, and said that it was "like in the spoon." Some of the subjects could not or did not give any reason for their conceptualisation of Mikas as a metal. These subjects seemed immediately to pick up from the story that Mikas is a noun and some sort of a substance. They speak of "stuff under sand." A few said that it is metal but could not state their reasons for thinking so. They tried to bend the Mikas objects and said "it's metal because it looks like it," "it is quite strong," and "you can make a spoon of mettile." These subjects often corrected themselves by saying something like: "I know I've got some of them wrong the last time." Many did not spontaneously connect information from the story about Mikas with information from the objects.

In the 9-year-old group, answers employing correct vocabulary went hand-in-hand with good background knowledge. It was clear that their auditory skills were better developed than they were in the two younger groups. These subjects were willing to guess and could benefit from information about the Mikas objects, but very often they failed to co-ordinate information from story and objects. They said, for instance, that Mikas was metal because the key in the sample was made of metal or they might relate their answer to the story by saying, "It's a mineral; it doesn't wear off easily; and that's the same with minerals and stones." The following is an example of Metalinguistic Plus Indirect testing with Charles (9.4):

Section 1.

A robber.

Section 2:

Mineral; because it doesn't wear off easily and that's the same with minerals and stones; I don't think it was right (robber).

Section 3.

Something hard iron; because it is hard.

Section 4.

Metal like iron; Metal; 'Cause it goes in the water, it doesn't get wet, it doesn't come out soaking. E: You said earlier that you thought it was some mineral because it doesn't wear off easily, and that there was some iron in the temple hall and now you say it doesn't get soaking? S: Yes, it is metal.

Section 6.

Metal. He had all objects correct in sections except section one.

He gave all materials correct except in section one.

Test 1.

Mikas

Polystyrene

Wood

Leather

Plastic

Felt

Test 2.

A flower

An animal

Metal

A bird

Test 3.

Mikas + sentence 2.

Test 4.

Very quick at naming all the materials.

Mikas

Plastic

Wood

Polystyrene

Leather

Felt

Test 5.

E: Can you now maybe draw me something made of Mikas?

S: Draws a spoon.

E: Where can you find Mikas?

S: In the ground.

E: On our planet or only on planet Oc?

S: Ours as well.

E: What did you like best in the story?

S: When they found the satellite.

E: What was the Ocs secret knowledge about?

S: The knowledge of making weapons.

E: Why did they want to hide their secret knowledge?

S: So the enemy wouldn't find out.

E: Do you think the Ocs were peaceful or violent?

S: Peaceful.

Posttests.

Test 1. Comprehension.

Mikas: A shiny rock.

Cobalt: Living things: I am not sure.

A geologist: Person who studies the Earth.

Distant: Far away.

Wee: Small.

To improve: Make it better.

Test 2. Production.

Gold

Steel

Iron

Silver

Copper

Tin

Bronze

If the 9-year-old children gave a wrong material from the test sample for Mikas, some repeated their error and did not try to use information from story, but rather clung to the test materials. They said, for instance, that Mikas is a metal because "it looks like it." They often used the expressions "it feels like," "it sounds like": "It feels like metal when you look at the things; but I am not very sure, so I think it might be plastic and a tiny bit metal."

Recall of the story in the 11-year-old group was good. They made many guesses about Mikas, and, having often heard it in the story, did not spontaneously connect earlier information with later information. Thus, they might say "glittering shiny, it was in the sand and in the hall, on fences, got very hot and burnt him," but still not be able to say what it was. Some said that it was in the sand glittering: "That's what the stuff is called on the spoon." These subjects related to objects like: "you gave me the spoon and they look like mettile and feel like mettile, too." However, other subjects related information from both the story and the test sample. A few made a mixture of a material and an object made of that material.

It is clear that the Metalinguistic and Indirect type of intervention provided the subjects with many clues to the meaning of the new term. When asked directly about the meaning of a new term, subjects who were not able to glean information from the text could use information from the test sample of objects to guide their guesses and to restrict their possible denotata. They also heard the new term more often than did other subjects, as reflected in their responses in the production tests later. However, as their drawings showed, they tended to be bound to the test sample of objects and not to be sure how to categorise the new referent.

The Control Condition.

Among the five-year-olds, the controls seemed to like the story and listened attentively; individual variation, however, was substantial. Only in a few instances did subjects show restlessness and start to talk about something else or start to move around. These young subjects seemed to gain some global sense of the story, but when asked about particulars or special events in the story, their memories often failed them. They often used their own imagination to compensate for their lack of understanding or memory. Usually their imaginative answers could fit with some broad global sense of the story and its central theme. There were gross individual differences within the age group as concerns willingness to report on the story; many subjects answered merely with "yes" or "no" and often the experimenter had to ask more specific questions in order to help them feel more confident.

The 7-year-olds were able to give a relatively good report on the story, but some of them used their imagination when their memory and understanding failed them. The 7-year-olds were eager to co-operate and to try their best at answering, even though they did somewhat poorly at times. Their reports showed a better developed sense for the story's central theme than was seen in the 5-year-old group; they also remembered more events and more about the main characters.

The 9-year-old subjects gave rather good reports, and if they didn't know the answers to some of the questions about the story's content they simply said that they didn't know and didn't try to make up answers, which was the tendency among the 5- and 7-year-olds. They clearly had better-developed memory skills and understanding. Some of them actually seemed to remember the story word-for-word.

The 11-year-old subjects answered almost all questions on the story's content correctly and did so with ease and clarity. Many of this group spoke spontaneously of Mikas after the first sections. They said: "This stuff all around," "stuff all around in the hall." "The glittering, the ground was a kind of glittering," "voices echoed in these," "some dust everywhere," "this metal or mahogany in the hall was very special," "something glittering in a big pile." But there were also subjects who never mentioned Mikas spontaneously. The following is an example of Control testing with Corrinne (11.8):

Test 1.

Wood

Felt

Plastic

Mikas S: Pardon? E: Can you give me please the things made of Mikas? Gives them over correctly.

Test 2.

It's a flower.

It's an animal.

It is -buh-, hesitates and thinks hard, a sort of metal, she then says questioningly.

It's a bird.

Test 3.

Matches Mikas with sentence 2.

Test 4.

Felt

Leather

Wood

Majes

Polystyrene

Plastic

Test 5.

E: Where can you expect to find Mikas?

S: I don't think you can find it anywhere, I don't think it is real.

E: But have you heard about it before?

S: Yes.

E: Can you draw me something made of Mikas?

S: Money can be made of it, she says, some sort of metal. Then draws a coin.

E: Can you draw me something else made of Mikas?

S: Draws a robot.

E: Do you remember something that was said about Mikas in the story?

S: In the sunshine it got very hot and you could burn yourself on it.

E: So you don't think this Mikas was real, but if you use your imagination, where then do you think one could find it?

S: On the planet.

E: And where then?

S: Just in some planets in the galaxy.

E: What did you like best in the story?

S: I liked it because they didn't know what would happen next and what they would find.

Posttests.

Test 1. Comprehension.

Mikas: A precious metal.

Cobalt: An even more precious metal.

A geologist is a person who studies geography.

Wee: Small, little.

Distant: Far away.

To Improve: To make it better, more advanced.

Test 2. Production.

Gold

Silver

Bronze

Brass

Ore

Mercury

Aluminium

Iron

Copper

Steel

Platinum

Cobalt

Mecas

Lead

It is clear that Section 2, with Mikas glittering in the sand, gave the strongest clue to the meaning of the new term. The control situation allowed continuity and a final global assessment after a unified presentation. In this situation, the child was presented with a general picture, allowing implicit connection of the word and its referent.

The new term was embedded in a continuous text and the information pertaining to the denotation of the term was indirect. The verbal responses to the stories were not as informative, of course, as were the verbal responses of the Metalinguistics, since controls were never asked direct questions about the target word. The children made use of information provided in the text in order to answer the questions. They may have retained some information that would have been useful when encountering the new term again and again in the sections.

There were cases in which the responses were a mixture of the child's own experience and information from the story. The child's response reflected an encounter with similar natural kinds in the world. This may have helped the child to create a frame that had something to do with metal substances or living things. A few children were able to use the new term spontaneously in a new but appropriate context. There were cases in which comments from the young child indicated that the child had a global understanding of the story, and among the older children, due to improved auditory skills, I presume, some were able to repeat the story almost word-for-word. In the Control condition, children had more time to learn about the subject matter, resulting in a grasp of the total meaning of the story.

Nonverbal and verbal IQ and auditory skills and the children's former general knowledge of materials clearly played a part in the young controls' ability to decipher when they saw the test sample. With the older controls, who knew all the materials except Mikas, there was no need to rely on linguistic information. There is no guarantee, either, that they had relied solely on non-linguistic contrasts. The controls often found it difficult to co-ordinate their information about the new word from the story with the sample of referents with which they were presented in the Test Phase. Some of these subjects said that they thought that the Mikas looked somewhat different and had to be encouraged and asked again for the Mikas objects. Some controls spontaneously corrected themselves and noted their mapping mistakes, sometimes as early as Test 1. Their main difficulty seemed to be that they had grasped some global sense of the new term, yet they had difficulty articulating the elements of the story that matched the word and link that information to the stimulus material of the objects made of Mikas. They clearly lacked experience in working out the extension of the underlying concept. Furthermore, there were subjects of all ages in this condition who stuck to their error patterns throughout Test Phase and Posttests. Some subjects in other conditions tended to do the same.

The controls did not get as much exercise as did the other groups in establishing reference. However, generally speaking, they did not fare worse, and even fared better, in some of the tests. They seem to have developed in their encoding intension or connotation of the term, a feeling, or inner sense for the meaning of the new term.

Discussion.

Vygotsky (1962) has hypothesised that the development of speech and thought in the first two years are parallel but unrelated; only after age two do they begin to fuse. He has argued that higher forms of human intelligence and thought are achieved because language is developed and that language rules are more sophisticated and abstract than what was previously believed. When mastering the knowledge of the many phases of linguistic meaning, the child needs not only the experience of the words themselves but also an understanding of the features and relationships in the outer world. When children enter school age, their semantic knowledge grows, together with their cognitive development; they develop new linguistic abilities and insight into their own language behaviour, or what has been termed metalinguistic awareness. In the years 9 to 12 the child grows in the cognitive ability to answer questions more sensibly, to use words more correctly, to define abstract words more precisely, to make generalisations from verbal and mathematical relationships, to see significant details in a situation, to detect absurdities, and to exhibit a larger fund of general information. It is important at this stage that the child is better able to use information that has already been acquired, in order to make judgements or deductions in areas that are only indirectly related to the information (Miller & Gildea, 1987).

By the age of five, normal children can analyse language into its minimal separable units of sound and meaning, use rules that they have discovered independently for combining sounds into words and words into meaningful sentences, and take an active part in conversations. Donaldson maintains that:

> It is a common but naive assumption that the understanding of a word is an all-or-none affair: you either understand it or you don't. But this is not so. Knowledge of word-meaning grows, it undergoes development and change. Also, the process of understanding an utterance does not just depend on the serial addition of one word meaning to another. It is an active process of structuring and making sense of the whole (1984, p. 73).

Age and Condition.

Age, the developmental variable in the three experimental conditions and the control condition, played a significant role in the acquisition process. together with the natural kind term to be acquired and the type of linguistic and non-linguistic knowledge that the child brought to the task. I had hoped to tap some of the developmental differences in the acquisition process and the underlying semantic and conceptual processes by designing the five test types analysed in the Test Phase.

It is clear that Age was a strong variable in the experiment. Performance increased as a function of age, older children performing generally better than the younger. However, much individual variation existed within each age group and many idiosyncrasies of response. It is interesting that the 9-year-old group often performed worse than did the two next younger groups. It seems that a shift was taking place, and, from the protocols, I assume that it was due to a rise in metalinguistic awareness that occurred at this age, plus the fact that, at the same time, the children were not flexible enough in these new strategies. They seemed to be easily led astray in their guesses, not yet having control of these newly mastered abilities of reflecting back on their language. Besides, the question still remains whether these new abilities are qualitatively different from the abilities of the younger children, or have been brought forth because of quantitative changes in knowledge, and in the restructuring of knowledge, and because of schooling and exercise in the older children.

In all conditions, the story context of the study appeared to be somewhat too complicated for the youngest subjects. Thus, their performance under these special conditions might not give a very accurate picture of their true capabilities in mapping the meaning of a novel lexical item.

There is a noted lack of interaction between age and condition and one can wonder if this indicates a similarity of functioning at all ages. Are the changes that are taking place quantitative rather than qualitative ones (Mandler, 1983)?

There was much individual variation in all the conditions--Control, Indirect, Metalinguistic, Metalinguistic and Indirect--and many idiosyncratic responses. The control subjects did very well in the experiment. In the depicting situation, youngest subjects did well, as did the youngest controls in the matching of word to sentence. The controls had their worst performance in the Production, in which they were required to name the referent. They heard the new term the fewest times during Encoding, which can account for some of the difficulties in their condition. The controls were thus not as familiar with the acoustic image as were the other groups. Also, not being too sure of the proper pronunciation, they may have chosen to stay silent.

Many researchers have reported a wide individual variation in acquisition rate (Griffiths, 1986; Campbell et al., 1982, Campbell & Dockrell, 1986; Crystal, 1971, 1987; Lyons, 1977). When the various developmental factors are assessed--language, understanding of concepts, drawing development--it is clear that there were differences between children of the same age and condition. Even within a single child, there was a diversity in these developments, as demonstrated in test performance. A given child may score like his or her age group on the first test and the drawing test, but score as a younger child in the other tests of category and word-sentence which require clear conceptual understanding. There are reported differences in auditory skills and in short-term memory based on these factors.

There were also differences in spontaneous corrections and in the use that the children made of that strategy. In standard IQ testing, children are allowed to correct errors if they do so without being prompted, while, for example, they are drawing from memory (Jónasson, 1967).

Most of the children, both younger and older, showed great interest and participation in the study. The administration of the tests was strictly adhered to throughout the testing, although the experimenter used her discretion in obtaining co-operation from an individual child. Training, skill, and experience are very important for the researcher in this type of experimental setting, because the situation, having little encouragement and feedback, is restraining for the child. In ordinary life, the child is used to receiving prompts. When the child is defining a word or selecting from a sample of objects, an adult might prompt him or her by saying something like: "Are you sure?" "Could it be the other one?" "Is this one similar to silver?" or "What can you do with it?" As Light and

Butterworth (1992) have said, "the child in discourse with the adult enters into a relationship of unequal power, where the child takes the adult's behaviour in context as a means to understand what is required" (p. 5).

What the child understood the experimenter to mean by her questions is clearly a very strong factor in the study. The dialogue between the experimenter and the child, as defined by each condition, establishes a framework for the sharing of social knowledge and cognitive growth in the child. How children in a given condition feel themselves to be, affects the extent to which the tasks that they are given in the situation harness their intentions (Light & Butterworth, 1992). It is clear that even if it were true that children in the study were doing their best in responding to the experimenter's questions in this type of setting, and focused on that interpersonal aspect of their situation, many still could map the new word properly.

The Revelations of the Tests.

The tests in the experiment were designed as assessment tools of the growth of word meaning in children. The tests were not intended to be "intelligence tests;" rather they were concerned with a range of functions. The total testing profile of the experiment included: a) language ability assessment, both comprehension and expression, b) verbal and imaginal coding, and c) general knowledge and IQ. The different tests reveal interesting individual variations in the sample and different testing profiles. The tests show much correlation among them, especially tests that were designed to test for verbal coding, comprehension, and general knowledge, and verbal tests correlate with tests of imaginal coding--high scores on verbal tests usually relate to good performance in the depicting tests--and tests that were designed for the production of the new term correlate with tests of comprehension and highly with tests that only test for categorisation, conceptual understanding and declarative skill based on the understanding of logical relationships between words in a taxonomy. These test results may indicate that the tests of production and of linguistic definitions better reflect true linguistic abilities than tests of comprehension, general knowledge, and imaginal coding which may be broader and cover a wider range of both linguistic and nonlinguistic functions.

In the experiment there were 76 children of the total sample of 160 children who had all the 5 tests of the Test Phase correct, and 123 children had all the remaining 4 tests correct when the Test of Production (Test 4) that proved the hardest had been omitted. Thus, the children showed very good performance in all age groups and conditions.

Two-Way Anova showed significant main effects of Condition, $F(3,144) = 3.43$, $p < .05$ and of Age, $F(3.144) = 48.06$, $p < .001$ for the combined score Full Meaning from all subtests in the Test Phase. Age group 11.6 performed best overall, particularly in the Metalinguistic and Indirect Conditions. However, age group 9.6 in the Indirect Condition performed better than did subjects in any other age group or condition.

A strong **correlation exists** *among some of the tests*: the strongest correlation of Test 2 (Category Definition) and Test 4 (Production) (.64**); then, among Test 2 (Category Definition) and Test 3 (Word Sentence) (.63**); among Test 3 (Word Sentence) and Test 4 (Production) (.58**); among Test 1 (Object Comprehension) and Test 4 (Production) (.56**); among Test 5 (Depiction) and Test 2 (Category Definiton) (.55**), and, finally, among Test 5 (Depiction) and Test 1 (Object Comprehension) (.53**). These tests clearly tap the interrelated functions of various psychological processes necessary for proper performance. Children who score highly overall score well in all these tests; on one hand, the tests of Object Comprehension, Category Definition, Word Sentence and Production may be highly related by their nature: the declaration and recall in Category Definition and in Production is based on recognition in similar domains and children who do well in all these tests have both the ability for recognition and for recall; on the other hand, little contamination may exist between some of the tests such as the tests of Category Definition and Depiction as they cover different domains, the correlation may indicate high scores for other tests and the requirement of a similar ability in discerning elements however in two different domains--the one of linguistic competence, the other of graphic competence--similar to having a good logical reasoning ability, that helps, for example, in tests of some mathematical ability (but not necessarily in other mathematical fields), and in tests of linguistic ability.

The order of the tests in the study is important. If Test 2, Category, had come after Test 5, Depiction, when the child had drawn a picture of Mikas, the child might have scored higher on Category, having gained learning experience from all the tests and having drawn a picture, and thereby learning from a productive action. But, then again as the tests tap different processes, this may not necessarily be so.

The sample used in the study rated above average in standard vocabulary tests of English, as reflected in high scores of children in the oldest age group, Primary 7, who take these tests before entering high school. When the results of the present study are evaluated, this fact should be borne in mind.

In the three types of experimental intervention, the subjects gained more practice in declaring something about the new referent, so that at least it was more familiar to them. As for the Controls, their knowledge was more procedurally based and there was a lack of practice in access to that knowledge. Their drawings were not as stimuli-bound as were the drawings of children in the other conditions. Once presented with the Mikas materials in the Test Phase, the Controls often said that they thought Mikas looked somewhat different from what they had thought when they had the test sample of objects in front of them. It is clear that the Controls drew pictures that often did not refer to the objects used in the testing session, and this happened more often with them than with any of the children in the other groups.

Those subjects who did not recover from an error--for example, confusing polystyrene and Mikas in the Encoding Phase--tended to repeat that error in later tests. However, there were fewer cases than expected of children in all the conditions repeating errors through the whole Test Phase and Posttests.

The Metalinguistic subjects found the questions about the meaning of the new word and other words to be very stressful. Their definitions were quite often based on the function of objects in their environment to which these terms referred. Even among the older children, subjects used descriptions more often than they used definitions based on the logical relationships between words in a conceptual taxonomy.

These subjects did not consciously connect the information they had given about the new term in section after section; even the older ones did not find this to be a natural process. However, metalinguistic skills were better developed in the oldest group, and those subjects had greater control over these skills: they could benefit from guessing, they guessed more freely, and they fluctuated between guesses.

The children's worst performance was generally in the test of Production. In the structured testing situation the term was apparently understood better than it was used. However, in the interview afterwards, it was used by some subjects spontaneously.

The same test sample of objects was used in the first test in the Test Phase (Object Comprehension) and in the Production Test, and thus familiarity with the stimuli referents was equal. However, as all other tests were testing for comprehension, it is difficult to compare them fairly. It is clear that performance was affected by having heard the word often during Encoding. Such was the case of the Metalinguistic Plus Indirect group as compared to the Control group in their performance in the Production test.

Joos speaks of the connotations of words or the intensions of concepts. Instead of arguing that children do err and are not able to recover from that error, it can be stated on basis of the results in the experiment that such repetitions of error were fewer than expected. I would argue that in all conditions the children's linguistic skill and knowledge of context based on experience came into play and helped in their recovery; however, the main differences were in the decoded connotations of the new term, and the control condition best helps call forth this aspect.

It would be appropriate at this point to rephrase the hypothesis put forth in Chapter 2. Instead of repeating their errors, children tried options and were quite adaptive. Repeated tests will show if the child in a same test makes the same response later or whether restructuring occurs.

The idea of the "function circle" (cf. Krampen, 1991) means that the entire context--what the child sees, hears and senses--is related to the words that are being said, and that it is this total picture that the child interprets as a certain message in an experimental situation like the one in this study.

If the child in the Control condition knows very little or has grasped very little of the topic of the story that gives the context for the Mikas material, the child has difficulties in making the "bridging" inferences necessary in order to understand sentences that assume that knowledge.

The production lists for the metal names in the Posttest indicates that children with large vocabularies of metal names tend to include Mikas in their list and to exhibit greater general knowledge about metals in their overall performance in Encoding, Testing, and Posttesting.

The communication situation itself created by the different manipulations in the study shows up very well in the effects of subjects' decodings in their drawings. The drawings produced in Test 5 are more stimuli-bound in the case of the experimental groups, and, in the case of the Controls, are based more upon earlier experiences of metallic objects. In both cases, the actively explored environment is a factor. This is reflected in how stimuli bound the drawings of the experimentals were and how much they were based on the presentation of stimuli materials. On the other hand, the influence of past experience of metals, knowledge, and memory of metallic objects is reflected in the drawings of many Controls.

Krampen (1991) argues that, "the context of children's drawings does not lie in the situation in which they are made. The more important context of children's drawings is mental (or cognitive) and, in addition, remotely environmental" (p. 221). Thus, says Krampen, experience is the main context in children's minds of stereotyped images such as those of a church or a house. With increasing age, children's drawings begin to approximate what Krampen calls "stereotypes" that are less a result of situational context than of experiences that the children have had when coping with, say, objects like buildings: walking around buildings, walking through buildings, hearing people talk about buildings, or seeing pictures of buildings in a book or on television.

The drawings of the Experimentals were more situation-bound than were those of the Controls; in some cases they were clearly copies of the test sample of objects. The Controls many seem to have sought the image of metal things in their memories, based on their experiences of metal things. Memory also may be a reason for the boys in the study performing better than the girls; they may be more familiar with metal objects. Their toys are more often made of metals than are the toys of girls; boys more often than girls play or work with metallic tools. Certainly, within the experiment, their lists of metal names were often longer.

On the following pages, examples of the drawings of the children in all age groups and conditions are presented (Fig. 2.7., 2.8., p. 125-126).

Figure 2.7. Examples of Drawings (Controls and Indirects)

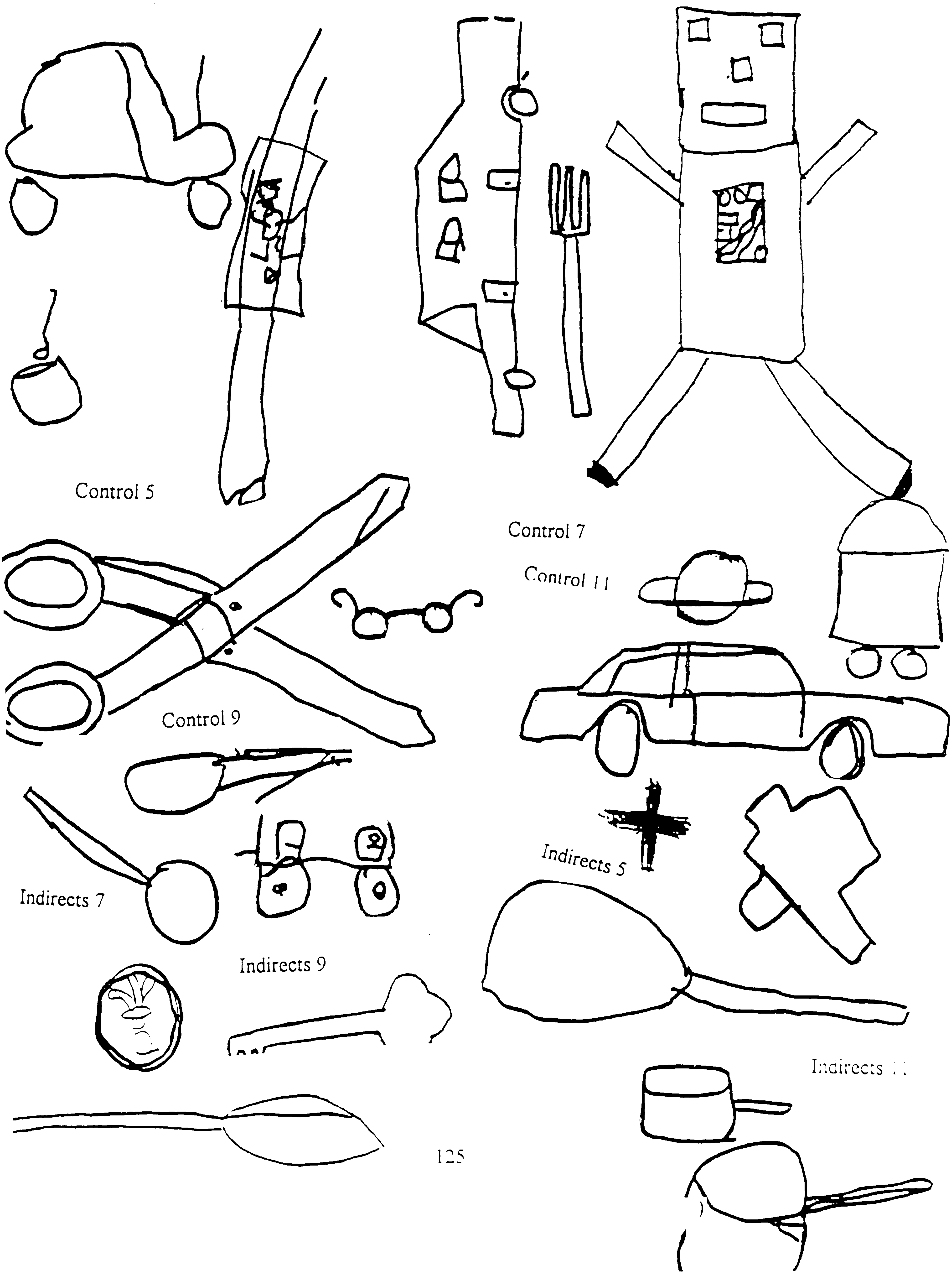
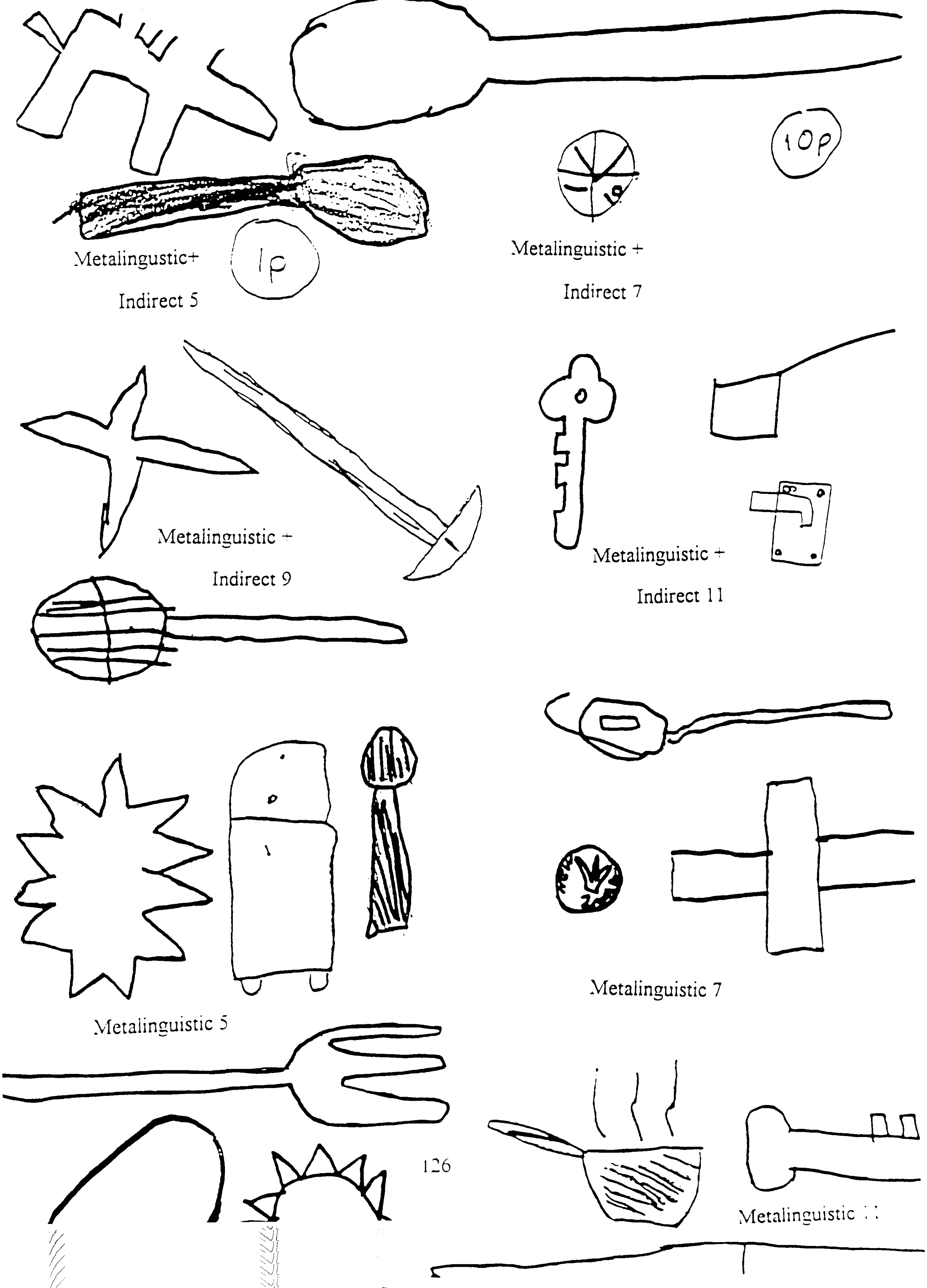


Figure 2.8. Examples of Drawings (Metalinguistic and Metalinguistic+Indirect)



Metalingustic+ Indirect 5

Metalinguistic + Indirect 7

Metalinguistic + Indirect 9

Metalinguistic + Indirect 11

Metalinguistic 7

Metalinguistic 5

Metalinguistic

Restructuring.

Differences in exposure, as in the four different conditions employed in the study, may lead children to different initial hypotheses about word meanings. Depending on their initial hypothesis about the meanings of new forms, they may follow quite different routes in arriving at the adult analysis. Differences in the input clearly affect the initial "fast mapping," following the child's first encounter with a new word. In case of the Indirects and the Metalinguistic Plus Indirects, their initial meanings of the new term seem to depend largely on the kind of objects or materials they manipulate in the test sample of materials to which they hear the term applied, together with their knowledge of the domain of materials they bring with them to the task.

It is clear in the study that the meanings of the new term for many of the Indirects and Metalinguistic Plus Indirects were based on the concrete test sample of objects of the various materials; hence they are ostensively bound. However, high scorers in these groups seem to have had linguistic skills and contextual abilities to overcome in their deciphering the ostensive nature of their conditions in which they have encountered the new term.

Among the high scorers in all the groups, many showed signs of general knowledge of mineral terms and situations where Mikas could be found and used. But they also seem to have good linguistic abilities, by which I mean knowledge of the lexical meanings of individual words, grammatical rules (syntax), semantic rules for interpreting sentences, discourse rules for interpreting texts, and pragmatic rules for interpreting speech acts as indicators of speaker's intensions for a proper mapping to be established and kept.

It has been postulated (Merriman et al., 1991) that certain non-linguistic intellectual capacities are necessary before any word learning takes place. In order to identify the intended referent of a word from nonverbal cues and to construct retainable representation of it, the word, and the association between these phenomena, the child needs to have acquired a certain level of attention, memory, and social skill. From the children's performance in the study, I would also argue that auditory skills are very important here. Children who report a great deal of the story, even remember it almost word-for-word, usually show correct mapping very early, and this does not change in the course of testing and posttesting.

Like Rosch (1973), Mervis argues that names for perceptually salient or important aspects of the world are acquired more readily than are labels for less noticeable or less valuable aspects (cf. Merriman et. al., 1991, p. 289-291).

Given that the children liked the target material, they should have learned its name more readily than the name of something they did not like as much, say, for example, the material "felt" in case of the young ones. In case of the concept of minerals, if a given child has a clear concept of these, the child may only have to map the new term onto his or her pre-existing non-linguistic concept.

Many accounts have been put forth as to the relationship among the various denotata that the child ascribes to a word. Vygotsky (1962) spoke of the child's concepts as associative and diffuse, and Werner (1948) maintained that complexive associations, shifting from one feature to the next, was the basis for categorisation occurring before any featural analysis took place. An initial complexive stage in word meaning was thus expected prior to a featural stage.

What has emerged from these speculations is that the young child may be relying on a variety of systems for categorising or a blend of acquisition strategies (Donaldson, 1978). Which process is activated may rely on the isolatability and saliency of criteria, together with the context in which the child first meets the word and initially believes that it is being referred to (Dockrell, 1981). There will be differences within a particular child and between children in the categorisation process. (It is also clear from Dockrell's (1981) data that different words may be represented in different ways.)

In the mapping process the child has been noted to make errors of overextension and underextension of the new term. When children overextend a word, they apply it to a denotatum that lies outside the proper denotatum of that term (according to an adult standard) such as when using the term "dog" to refer to "cat," or different types of animals, or to use the term "silver," over different metals including "Mikas." In underextension, the children's denotata are only a subset of the denotata usually included in the denotation of the particular term being used, such as using the name of a particular dog, "Fido," only for that particular dog, but not for other dogs that also are called "Fido," or, for example, including objects made of metal, such as legs of stools, gold bracelets, silver rings, as happened in the present study, in a list of metal names.

There is thought to be a natural level of categorisation by which the person processing the information creates a balance between increased similarity as obtained from a superordinate category and increased contrast, as obtained from a subordinate category. These features presumably aid children in their categorisations, and for them to map words and concepts at this level would appear to be a natural process. It is through that process that children form categories like "chain complexes," as suggested by Vygotsky (1962), rather than sorting superordinate categories properly into conventional taxonomies. However, if the constraint of mapping names denoting concepts at the basic level of categorisation as part of a taxonomic hierarchy, the child would have difficulties in ever learning the names for concepts above and below this basic level. However, this is not what natural word learning shows; the child also learns names for superordinate and subordinate categories. It is more likely that the child develops a rich network of relations among concepts in the process of language acquisition and even if such relations are a late acquisition, this network would pave the way for taxonomic categorisation, and was shown in greater skill among the older subjects to define word meaning in terms of other words to which the words asked about were logically related.

Features are perceptually salient aspects of the materials used and are very likely to be probed automatically. The child's knowledge about the features and the different properties of the materials is crucial in a mapping of these features: whether, for example, a given material is shiny and soft or shiny and hard, or whether or not it is breakable.

The undifferentiated patterns of young children may be a factor in their underattribution of features and properties attributed to metals. Thus they may, for example, include leather, which is light and soft, in their groups with the Mikas objects, or hand leather to the experimenter when asked for Mikas. Or they may, together with some older children, overattribute features to Mikas, include the glittering polystyrene, and cling to polystyrene in the tests.

Thus some error responses may stem from inadequate knowledge of materials in general, but as the conceptualisation of materials becomes more differentiated with gains in knowledge, there is the possibility of better-structured domains for each material and more declarative skill on the child's part. Material properties are not completely undifferentiated in some children; greater differentiation can be seen in this study as a function of both age and knowledge.

It is clear from the data that some young children know too little of the particular features accompanying each material to see the relevance of the distinction between Mikas and the other materials. Commonly, this happens with some older children as well; they include two or more materials in a single category of all ages. Most children could sort the materials properly, bearing in mind that the youngest children had fewer items of each material than the older children did. This may be in line with Carey's argument (1985) that in a given domain such as the one of animals--a single set of features weighed for relative salience--may underlie the young child's representations of all objects.

Polystyrene may be closer because of appearance to the prototype that children hold for metals if they do not have a strong enough grasp of the underlying features. But another factor could explain these mappings: namely, that the child finds polystyrene to be less familiar, perceives the Mikas to be some painted metal, like steel, and chooses the unfamiliar-looking material to map onto the new term.

The context of the word's presentation must be given proper weight. If the child does not realise the syntactic class or relations, the ontogeny of word meaning is a long drawn-out procedure with many possibilities for errors. Barett (1978, 1982) argues that lexical development depends on both the store of phonological units available for the child to use as words and the conceptual system available for mapping meaning onto these units.

The children in this study were dealing with the acquisition of terms of concrete reference and could be trapped by compounding real-world knowledge with semantic knowledge. They appeared to be constructing a store of knowledge relevant to "Mikas." They had explicitly and implicitly been told that the key items were substances of some sort and they seemed to be sensitive to these cues.

The children in this study were using the perceptual and linguistic contrasts in the experimental situation to form an initial referential relationship. The set of objects was not too sharply circumscribed; however, most children who do respond realise that Mikas denotes a substance satisfying some set of perceptual criteria and have incorporated the new term into a particular semantic domain. However, it is not always clear in these data whether the children base their inductions about the new concept of the mineral term on category membership or on perceptual appearances.

Conclusions.

The result from the Test Phase and Posttest suggest that there are strong grounds to argue that many subjects know the denotation of the term and have mastered the sense to some extent. For many children, full mapping of the new term is well on the way to completion: "Being able to identify distinctive features of an object is a clear advantage in isolating one particular referent from a group of possible referents" (Dockrell, 1981, p. 178).

Even the youngest children in this experiment had fairly firm criteria for substance concepts, and this knowledge had implications for their learning. Let us suppose that the child entering the experiment already knows what a substance is. When this child is exposed to a new term, which s/he takes to denote a type of substance, it is necessary only for her/him to add this new substance term to a previously established lexical/conceptual framework. It is clear that in this type of situation that the child sees the new word as referring to a substance. The alternative in the situation is to take the new word as an object made of a substance like metal, given that the child knows the other materials in the test sample.

For subjects in the experimental conditions who have not become confused among more than two materials, it is possible that they can correct themselves within the sections. Also, subjects in this group start to attend more clearly to Mikas in the story and mention it: e.g. "Mikas in the hall." They are more aware of having made a mistake.

Success on tests in this study can be related to success on tests of corresponding concepts--e.g. the Category Test and the Word-Sentence Test. A child who fails Category very seldom maps properly in Word-Sentence.

The children seem to make use of analogy mechanisms. Very often, when asked about Mikas, the subjects say, "It looks like silver or gold." It seems, in this situation, that they are making use of resemblance rather than identity.

Light and Butterworth (1992) have argued for the process of decontextualisation, and the extent to which the process occurs would enable "generalisation across various contexts through reasoning by analogy with aspects of the situation where the problem was first encountered" (p. 153).

It would have been interesting to include objects made of gold or silver in the sample: material of the same category but differing in appearance, in order to see what sorts of mappings the new term would generate. Also, our including spoons and screws and coins in the test sample of materials may account for some of the correct mappings in all groups. A child who knows all the other materials does not have to rely on any linguistic information from the story when asked what Mikas is; it must be the unknown quality. From the store of the subject's background knowledge, s/he may infer that the object must be metal, since spoons, screws, and coins are usually made of metal.

When speaking of children's conceptual development, Carey (1985) argues that children restructure their conceptual development between the ages of 4 and 10. She speaks of a restructuring of knowledge as well as an accumulation of new facts--new production rules in different relations among concepts and in patterns among new relations that motivate the creation of new abstract concepts and schemata. These abstract concepts and schemata may not be represented by the young child, or they may be represented tacitly but not accessible to them. What is basic level for the young child in terms of metal substance may be subordinate level for the older children. For the youngest children, "mettile" seems to be the basic level, whereas, for older children, the name of metals is the basic level. For the little children, as reflected in their production lists in the Posttesting, the word "mettile" is more common and lists of objects made of metal than there are metal names. There were, however, young children with well-structured vocabulary who included names of metals in their lists. It should, however, be born in mind that among the young ones there are high scorers who contrast the metal names at the same basic level as the older ones, or as an adult would do.

It is not often that a given child uses a single criterion in the justifications of mapping Mikas as metal. It is clear in these data that a given child produces many different kinds of justifications when asked for reasons to map Mikas as a metal substance. Some productive process (Carey, 1985) seems to underlie the child's judgements, even if they are based on decisions of category membership.

When the child attributes certain features of the metal substance to plastic or polystyrene, this may reflect a semantic rather than a conceptual problem. There may exist a difference in the development of the meaning of the word "Mikas" and the development of the concept of material. The meaning of the word "Mikas" does change with age but the development of the underlying concept of material/metal can be related to the acquisition and reorganisation of the child's knowledge of materials. Restructuring in this case would implicate a basic level: a subordinate shift. Restructuring in the course of encoding and decoding is a clear factor in the study and, in fact, is the main conclusion of Experiment 1.

CHAPTER 3
EXPERIMENT 2
A NOVEL VEGETATION TERM

Introduction.

In Experiment 1, many children, regardless of condition, overcame the ambiguity of the unstructured setup of the test materials with which they had been presented. I would argue that this happened because of the children's former knowledge of materials, but also, as was the case of the Control children, and of many high scorers in the experimental conditions, because of the linguistic abilities that the experimental setup brought forth and very excellent linguistic abilities of the children that overcame the ambiguities of the experimental setup.

The children in Experiment 1 in all age groups may have based their knowledge of the materials on observation and experimentation in daily life that had adaptive and heuristic value. I learned from the teachers in the school in Callander that the oldest children had recently been working on a topic on minerals as part of a geology project; many of these oldest children gave very long lists of metal names in the Posttests when they were asked to make a list of minerals that they knew. During the experiment, the children may have reasoned, from their own basic experience of materials to the specific metal material in question (Mikas) through a rationale such as: "This material is metallic, and all these metallic objects look the same; therefore it is very likely that they are all of the same metal substance." Thus, categorisation may have provided the base for the children's subsequent mapping of Mikas as a metal substance, situated their thinking within the given frame of the experimental situation, and structured their thinking.

The children's performance can be regarded as being based on a competence that is a function of the context of each of the four conditions employed in the experiment, and a function of the content of the child's pre-existing knowledge structures and linguistic abilities. The child's sensitivity to the meaning of the new term is based on his or her perception of the linguistic input and of the test situation. In order for the children to derive meaning from their experience in these circumstances, they must rely on contextual variables. Light and Butterworth (1992) argue that "perhaps competence is a function of contextual variables and this is why performance varies from context to context" (p. 14). They speak of the importance of "situated cognition" in the cognitive growth of children and of contextual factors in the "restructuring of knowledge." Furthermore, they maintain that contextual factors operate at different hierarchical levels. The effects of these factors through language, perception, and attention situate the individual in a physical and social reality. It is the perceptual field that provides the public frame of reference within which socially shared acts of communication occur:

> Language, developmentally speaking, marks the attainment of another cognitive level, and refers to the objects which exist in the space held in common by speaker and listener. The perceptual field may have priority in development and for referential communication (Butterworth and Jarrett, 1991), and it may be the first contextual determinant on which other contexts are founded (p. 8).

Brown (1957) suggests that part-of-speech membership of a new word can operate as a filter, selecting for attention relevant features of the non-linguistic world. Language is thought to be a relatively late invention on the evolutionary time table and much of its evolution may have to do with intuitive analogies, a characteristic of the speech of primitive people and of young children as noted by Werner (1948). Thinking in spatial analogs may have preceded verbal thinking, and language may have evolved after prehistoric peoples were using thought to solve problems and even after they were making cave drawings to represent what they believed to be of significance in their lives. Joos (1958) contends that each language decides on the basis of its own categories, which will be different from one language to another, e.g. usage of past versus present tense, or singular versus plural number (cf. Whorf, 1956). Together with Chomsky, Whorf has argued against too much emphases on the ostensive definition of meaning. As cited in Hill (1970) Chomsky noted that: "the only kind of reliance on meaning which is certain to fail is the attempt to define meaning by pointing to objects and classes of objects in the outside world" (p. 254). Joos (1958) stresses the connotative aspect of meaning, or the intension of the underlying concept that the hearer or the reader deciphers very rapidly in the processing of linguistic messages from a given text. He argues for "*the autonomous focusing of attention without listening.*" In this distributional theory of meaning, Joos proposes that a linguistic item does not refer to items in the real world by fixating the listener's attention upon the real world referent; rather, the linguistic item "refers to" the referent in the real world because collocations that work within language have stripped the linguistic item of so many other meanings that only this one is left: "Now this wandering of limited attention at every moment obviously eliminates certain candidates for election as referent" (p. 67). The semantic content of a given word is determined by an entire series of subconscious associations that tie the word into consciousness. These associations are called the connotations of the word and can be different for every individual, but are likely to have much in common. A word is thought to receive its connotation through the past contexts in which it has been experienced, or its referent, or both together; whereas the denotation of a word is the so-called "actual" or "dictionary" meaning of a word. This definition suggests that a word has a fixed and ascertainable meaning common to all persons who use it, an assumption against which Joos has argued. Rather, Joos argues, the recognition or use of certain words does not always require an accurate knowledge of what these words really denote and since there is a certain ideational haziness of denotation of many words, such as abstract words, perfect understanding of linguistic information is rare.

It is clear that the "intuitive behaviour" of the children in Experiment 1, regardless of which condition, was being misled by many factors within the children and situation in which they perceived themselves to be. Therefore, it was decided that a different experimental design would be needed in order to reveal whether or not there are real differences between different encodings of a new word when children are presented with a story context in which they encounter a new word a few times.

The Object of Study.

In Experiment 2, the subject's task was to plot the meaning of an unfamiliar vegetation term, Kelaph, which denoted an unfamiliar desert plant, and with which the subject had had three different encounters in the story. The story itself was in three sections, each of which contained the new word once.

As in the Mikas study, subjects were exposed to interference with their acquisition through direct and indirect manipulation of the target word in the intervals between the sections of the story. Two experimental conditions corresponded to these types of manipulation. A control condition avoided such interactions.

The stimulus material used in the Kelaph experiment differed from the Mikas material in that the subject had two tasks: a) to indicate which symbols in a symbol sample of four symbol classes best represented the meaning of the new word, and b) to choose the possible referent for the new term from a test sample of objects drawn from the denotation of the same symbols.

By using some symbolic presentation of the real world referent, I hoped to gain more control over the real contribution of the linguistic encounters that the children have with the new word versus the contribution of the non-linguistic context of the study, or the more concrete contexts that the presentation of stimulus material offer.

Krampen (1991) maintains that at 4-year-old children are at the symbolic stage in their drawing development and should be sensitive to caricatures (cf. Bruner, 1966). Therefore, I predicted that young children in the study would not be perplexed by the caricature-like appearances of the symbols. The context and the communicative nature of the task in Experiment 2 was given to the children when the experimenter first introduced them to the symbols used in the experiment. It was explained to the children that they would be told about things in the story that these symbols stand for and that they would later be asked about them and about some words that they would hear in the story.

The symbols used in Experiment 2 originate from the native culture of the Pimas of Arizona. Being somewhat abstract, they can be regarded as figurative drawings. It is known from common experience that even young children are many extremely adept with toy puzzles and good at figuring out cartoon figures and that they seem to develop sense for shape early. Other experimenters have used non-figurative drawings in conceptual learning studies; Fisher (1916), for example, used such stimuli with adult subjects. In these cases, the drawings are regarded only as drawings and the subject is, from the beginning, given the instruction that they do not represent real objects.

One such example of figurative drawings is a grapheme, which Whorf (1956) defines as a word formed on the analogy of morpheme, semanteme, to denote any written symbol, especially a linguistic factor, in place of an "ideogram," "pictograph," or the ambiguous "character." A sign can be a hieroglyphic element of wide and varied use. Each sign, for example, in the Mexican day-sign system, has a name and a special grapheme that may resemble living things. For example, the Mazatl day sign has a grapheme that is a deer's head. Whorf maintains that when discussing hieroglyphics it is desirable to have a term that does not presuppose anything about the nature of the denotative process employed. Whorf stresses the role of resemblance in the deciphering of graphics:

> Hence the fact that some individual signs look like pictures of the things or ideas denoted by the words of the utterance plays no real part in the reading. Those signs are just as much symbolic, learned, and at bottom arbitrary signs for fractions of utterance as any other characters or letters. On the other hand, resemblance to an object or picture may be really important in decipherment, as a clue to how the sign came to be invented, to the logic of its original use, and hence to the fraction of utterance, i.e., sound, which answers to it in reading a clue to be tested by how well that proposed fraction, or sound, fits into each proposed reading (p. 178).

Method.

In Experiment 2, the children are told that the drawings that they will be presented with resemble real objects spoken of in the story. Now, nonverbal skills that underlie factors such as visual discrimination play a much heavier role, than in Experiment 1.

The point of using more figurative-looking materials--graphemic caricatures in the form of simple Pima symbols in the Encoding Phase--is to eliminate bias due to the use of the same materials in Encoding and in Testing. It was clear in Experiment 1 that the results of children of both the Indirect and the Metalinguistic Plus Indirect conditions were influenced by the familiarity that they had already gained with the test materials during Encoding; whereas subjects of the Metalinguistic and Control conditions did not see the test materials until Test 1. Therefore, I decided to use denotational material in Test 2 in the Test Phase in Experiment 2 that none of the children had seen before. These materials were clay models of the same referents as those represented in Encoding and Test 1 by graphic symbols.

In the experiment children in all three conditions--Indirect, Metalinguistic and Control--saw these clay models for the first time in Test 2 and thus they had equal experience of them. This test should therefore provide a less biased comparison than Test 1.

If the specific nature of the acquisition phase at each of the three levels of exposure to the new word influences, at least to some extent, how the children encode the new word, their responses may reveal something about the inferences that they make. Again, these inferences possibly reflect some of the covert conceptualisations that underlie lexical entries and play a crucial part in the development of symbolic skills in the growing child.

The evidence from the Mikas study is that the control subjects, who underwent a holistic encoding procedure, seemed to gain greater sensitivity towards the intension of the new word. For example, their drawings were not so bound to the referent stimuli in the test sample as were the drawings of the other groups. However, it would be an overstatement to attribute such differences solely to the experimental manipulations, as there are multiple variables entering into all the conditions, and individual differences in intelligence and lexical knowledge that the children bring to the task are crucial determinants of performance. The general performance of subjects in the Mikas study suggests, regardless of condition, that children use many means to acquire language, and that they learn it in spite of themselves. However, some general trends in response patterns were present in Experiment 1, trends that the methodology helped to call forth.

In Experiment 2, I had hoped, in the interest of control, to simplify the former design and to use a different test material and one meaningless word, together with a new lexical item, the unfamiliar plant term. Children in this study encountered the new term in fewer contexts. Both a target word and a control word were used. The Metalinguistic Plus Indirect condition was not incorporated as in Experiment 1, as it was thought to give too much information to the children. They could extract information from both the test sample of objects and from the linguistic context of the story. All this information biased their responses and clearly raised their scores in Experiment 1. The interview in the Test Phase at the end of Experiment 1 was therefore incorporated as a separate test and also the Production post list in the Posttest Phase of Experiment 1 is incorporated as a separate test.

Thus, this experiment tests the ability of 4- to 10-year-old children to decipher the meaning of an unfamiliar word denoting an unknown plant, "Kelaph," from a story that was read to them. The new word appeared in three different sentential contexts within the story. The experiment consisted of two parts: a) an Encoding Phase, in which the children heard the story and received different forms of questioning between three chapters, depending on condition, and b) a Test Phase, consisting of six comprehension plus production tasks.

My hypotheses are: a) that early meaning-oriented questioning in the two experimental conditions would suppress the natural heuristics of lexical acquisition, leading to erroneous entries for the new term; b) that age would be important in that regard, as there would be more correct answers to the meaning of the new word with growing age, and, c) that control subjects who were questioned about theme and plot should not be affected in this way.

The children's responses were tape recorded and observational notes taken as the experiment was conducted with each child, in order to gain a comprehensive picture of each child's overall performance. The scoring procedure was the same as the one adhered to in Experiment 1: correct answers were scored "1" and wrong or no answers "0." (See Experiment 1, p. 47-48 and p. 64-65 for a more detailed description of the scoring procedure).

Subjects and Experimental Design.

The sample of 192 children was divided into four age groups, consisting of children from Nursery, Primary 2, Primary 4 and Primary 6, with an equal number of boys and girls from each age level. As before, the main experimental variables under consideration are age level, type of intervention, and sex. Two different experimental, and one control condition were employed. Subjects at each age level were randomly assigned to these conditions. The subjects ranged in age from 4.3 to 10.2 and were divided into four age groups with the mean ages of 4.6, 6.6, 8.6 and 10.6 referred to below as the 4-, 6-, 8- and 10-year-old groups. The total sample of 192 subjects was drawn from two primary schools in Central Scotland. These schools are located in similar areas as regards living standards and social environment. There were therefore four age groups of 48 subjects each and 16 subjects in each condition, with an equal number of boys and girls. Half of the total sample of 192 were children who had participated in Experiment 1 a year earlier. They were thus already familiar with the experimental setup employed and knew the experimenter well.

Materials and Procedure.

A further series of tests was designed in the hope of qualifying and modifying the conclusions arising from the first experiment. The overall experimental setting was that of a story, presented in three sections, about the Pimas of Arizona, a Native American tribe. The children were invited to examine some symbols that the Pimas had used instead of letters and which represented objects from their surroundings and daily life. The children were also told that they would hear a story about the way the Pimas used to live and that listening to the story and being presented with the old symbols would help them to crack an old Pima code. The main story theme was the one of the Thunderbird and the sustaining of the old Pima culture. In the course of the story, subjects heard the new term, "Kelaph," three times. Kelaph denoted an unfamiliar desert plant. In addition, they once heard a control word, "Bareg," denoting an unfamiliar bird. Two objects used in the Test Phase were also mentioned in the story: a sandstone rock and a desert lizard, called a Gila monster. The rock and Bareg are mentioned only once, whereas the lizard appears in three contexts within the same section of the story. The lizard, I thought, looked like something that children might easily consider to be a monster. These objects share few properties with Kelaph besides being natural objects. According to Carey (1985), both the bird and the lizard should be closer to the concept of "alive" for 4-to-10-year-old children than should

Kelaph, which, even if alive, does not breathe, reproduce, or move itself, and is therefore farther from the prototype for living things than are the bird and the Gila monster. All of the test materials, including the rock, can be crushed, only one grows, not all are edible, and all can be used for something.

The story used in Experiment 2 was shorter than the story used in Experiment 1, and the children listened to it on audio tapes. The new term, "Kelaph," since it denoted an unfamiliar desert plant, should have been defined at the same level of categorisation as was the control term "Bareg," which denoted an unfamiliar bird. The lizard was referred to in the story as the Gila monster. When the children were asked for the symbols representing the Gila monster, they were only asked for "the monster symbols." Similarly, the rocks were not named, and the children were asked to hand over "the rock symbols". Thus, "monster" and "rock" were defined at different level in the taxonomic hierarchy than are "Kelaph" and "Bareg" and the children had to shift between these levels in their mapping of the four groups of symbols when handing each group to the experimenter as requested. Rock was expected, on the basis of pilot testing, to be the symbol most correctly identified. (See Table 3.2, p. 146 for an example of text from the story).

Encoding Phase.

Two different methods were used to probe word knowledge during the Encoding Phase. In the experimental conditions, the subject's understanding of the stimulus word was probed by means of questions. In the Control condition, more general questions about the story were asked. The story was presented in three sections. In all three conditions, subjects listened to a tape-recorded story for six minutes at each time. The tape was then stopped and the subjects were asked different types of questions, according to their condition. After answering the questions, they listened to the next part of the story, were then interrupted, and questioned as before. The Encoding Phase took 15 to 20 minutes to present and the Test Phase took place immediately afterwards. During the Test Phase, the children were presented with six tasks that had been designed to map their lexical entry for the novel term. This phase took about 15 minutes, and thus the whole Experiment took 30 to 45 minutes, although time varied a bit, mainly as a function of the children's age. A period of

6 to 8 weeks was allowed to pass before the child was presented with a Posttest of five different tasks aimed at estimating his or her comprehension and production of the newly acquired term. (See Table 3.1, p. 145 for the sentential story contexts for the new term. Kelaph).

Table 3.1.

The Three Sentential Story Contexts for the new Vegetation Term, Kelaph.

1) They collected the Kelaphs in the desert and used them to dye their soft deer skins red.

2) The medical knowledge of the Pimas' ancestors had taught them how to heal their warrior wounds by using a bandage of some crushed Kelaphs.

3) The Pimas had learned to use the acid juices of the tough skinned Kelaphs to engrave designs on the shells.

Table 3.2.

An Example of Text from the Story.

Section 2.

The Pimas believed in the Great Spirit. Occasionally, or so they believed, the Great Spirit manifested itself in the disguise of a bird of an enormous size. They held the bird in great awe and called it the Thunderbird. By the work of the Thunderbird, the Earth was watered and vegetation grew. He carried a lake of fresh water on his back, which caused a great downpour when he flew through the air. Also, the Pimas believed that lightning flashed from his beak and that the beating of his wings was the rolling of thunder. The Pimas saw the Thunderbird as a guardian of their old clan. Incidents of warfare with other clans were few, and the Pimas never fought a war except to defend their territory. Their worst enemies were the Apaches. The medical knowledge of the Pimas' ancestors had taught them how to heal their warriors wounds by using a bandage of some crushed Kelaphs. Another dangerous enemy of the Pimas was Gila, the desert monster which they feared more than anything else. However, the question still remains whether the Gila was an actual monster or a tall dust monster that arose every noon because of the whirling winds that then swept the desert.

(The whole story can be seen in Appendix B, p. B1-B3)

The Metalinguistic Condition.

Following each story section, the children were asked directly about the meaning of the new word, "Kelaph," and asked to justify their answers. They were also asked about two words from the preceding section. For Section 1, the words were "Kelaph," "guardian," "clan." For Section 2, they were "Kelaph," "to scatter," and "crushed." And for Section 3, "Kelaph," "jingling," and "disguise."

Children in this condition were asked three times about Kelaph, but once about each of the other words. The children were asked if they knew what the word "Kelaph" meant, if they had heard it in the story, and, if so, what they had heard or what they could remember about it. When they gave their definition for the novel word they were asked to state reasons for the definition. They were also asked to compare the definition with the one or the ones that they had given in former sections, and to state how well the definition would fit with the present definition.

The Indirect Condition.

Following each story section, children were given a test sample of 16 Pima symbols. The symbols differed in shape and colour and there were four in each of four classes. The four classes also differed in size and position. The children were asked to sort the symbols according to shape, not according to colour: "Can you put together all the symbols of the same shape?" There was a blue Kelaph symbol 57 x 37 mm.; an orange Kelaph, 118 x 95 mm. , a violet one 85 x 82 mm. , and a yellow one 71 x 48 mm. There was a blue Bareg symbol 113 x 53 mm. ; a red Bareg 130 x 69 mm. , a green one 112 x 99 mm. , and a black one 72 x 50 mm. There was an orange Monster symbol 116 x 57 mm.; a violet Monster 107 x 56 mm. , a black one 80 x 34 mm. , and a green one 107 x 54 mm. Finally, there was a brown Rock symbol 82 x 52 mm.; a green Rock 91 x 45 mm. ; a pale blue one 79 x 58 mm. , and a blue one 53 x 44 mm. When the children had grouped the symbols, they were asked to give them over to the experimenter according to name: "Will you now hand me over the Kelaph symbols," "the Monster symbols," etc. (See Photo 3.1, 3.2, 3.3, 3.4, p.152-155). For the two youngest age groups, Pilot Testing had shown that to work with all the symbols was too confusing for them and instead they were given one to two symbols of each class.

The Control Condition.

Following each story section, children were asked three to four questions about the theme of the section and its main events. The questions used in Section 1 were as follows: "Can you tell me in what sort of land the Pima Indians lived?" "Did they grow something in the desert?" "Were they an old or a young clan?" In Section 2: "Did you hear about the Thunderbird?" "What did the Thunderbird do for the Pimas?" "Did they have some enemies in the desert?" In Section 3: "What happened at the Thunderbird festivals?" "Was there something strange about the high priest's lodge?" "What about the spirits?"

The questions were somewhat simplified for the younger children. The children in the Control condition had no experience of the multiple-choice set of symbols or of questions aimed at estimating their mapping of the new word. They were therefore unfamiliar with all the tasks in the Test Phase and had not heard the word as often as children in the two experimental conditions.

Test Phase.

Six tasks were designed to test comprehension and production of the new term, "Kelaph." The rationale behind these tasks is the same as was used in designing the tasks for Experiment 1 (see p. 62-68). The same strict scoring procedure was employed as in Experiment 1 (see Experiment 1, p 47-48 and p. 64-65).

After listening to all the sections of the story, children were presented with five tasks, designed so as to allow for the testing of their comprehension and production of the new word.

The five tasks were as follows:

Test 1 (T1): Symbol Comprehension.

The child was presented with the same set of symbols as were used in the Indirect Condition in the Encoding Phase and was asked to sort them and to hand them over according to name: "Will you now hand me the Kelaph symbols, please?" In the Test Phase, all children were asked for the symbols, and later for the objects, in the same order: Rock, Kelaph, Bareg, Monster. The total context of things of nature was given to the child and his or her sensitivity for the task demands brought forth and a universe of discourse established between the experimenter and the child when the child was asked for the rock. Pilot Testing had shown that it was too confusing to use randomisation of both symbols and objects for each child. Therefore, it was decided to ask always for symbols and for objects in the same order during Test Phase: Rock, Kelaph, Bareg, Monster. In this first test, children had to comprehend the denotation of actual objects, the plant Kelaph, "in the real world," as denoted by symbols in the test.

Test 2 (T2): Object Comprehension.

The child was shown a test sample of objects made of grey clay, which were more concrete representations of the Kelaph, the Bareg, the Monster and the Rock or the referents that the symbols in Test 1 stand for or symbolise (see Photo 3.5.A., p.156a). The Kelaph clay model was size 24 mm. (h) x 62 mm. (w) x 74 mm. (l). The Bareg was size 41 mm. (h) x 36 mm. (w) x 50 mm. (l). The Monster was size 28 mm. (h) x 41 mm. (w) x 80 mm. (l). The Rock was size 36 mm. (h) x 37 mm. (w) x 62 mm. (l). The children had only one of each clay model representing the Kelaph, Bareg, Monster and Rock in their test sample. This was a test of knowledge of denotation, as the clay models were copies (to some degree of accuracy) of the denotata (see Photo 3.1, 3.2, 3.3, and 3.4, p. 152-155).

Test 3 (T3): Production.

In this section of the experiment, the children were asked to match one symbol of each symbol group and one clay model. Having done that, the child was asked to name these objects: ("Can you tell me the name of this one?") as the experimenter pointed to the objects. This test gives scope to tap the children's declarative or expressive skill and to compare their performance with their comprehension in the two former tests.

Test 4 (T4): Categorisation.

In the fourth task, the children were shown a four-field layout with four different symbols, one of which, the Kelaph symbol, they had seen before. The other three were the butterfly, deer, and spider symbols. On the layout, there was a red Kelaph symbol, size 80 x 64 mm, a violet butterfly symbol, size 92 x 60 mm, a brown deer symbol, size 80 x 56 mm, and a black spider symbol, size 78 x 75 mm (see Photo 3.6, p. 156b). The children were asked to show the experimenter the Kelaph symbol and were then asked what they thought the other symbols represented. The experimenter asked: "Can you show me the Kelaph symbol?" Then, about the other three: "What do you think this symbol stands for?" The children had to rely on guessing for these three, and it was only the Kelaph that was scored: 1 if the child showed it, or pointed to it correctly; otherwise 0. The guesses for the other three symbols were probed. This test gave scope to estimate if the child had worked out proper reference and denotata of the new term.

Test 5 (T5): Depiction

In the fifth task the children were asked to draw a Kelaph. This test gave access to the children's mental images, their internal models of the features present in the test samples or of their experiences of plants or other objects of nature used: Rock, Bareg and Monster. This test taps declarative skill and denotation in giving scope for procedural understanding to be manifested.

Test 6 (T6): Interpretation.

Finally, the children were asked questions about why they thought a Kelaph is what they claim it is. Also they were asked some brief questions about the story they had just listened to. They were then told that by helping the experimenter they had contributed towards the understanding of the old Pima picture symbol code and that when they come back for more work they would be shown photos of the real things that the symbols represent. In the two youngest age groups, children were given a choice of sentences if they paused and if they could not state directly what a Kelaph was. They were then asked: "Could it be a stone, an animal, a plant, or a bird?" This test provided the possibility to determine if the child had worked out criteria for defining the semantic domain of the new term and its sense relations to other words. This test was expected to have a potential for providing higher scores, since it was the last test in the Test Phase and the children had become acquainted with the linguistic material.

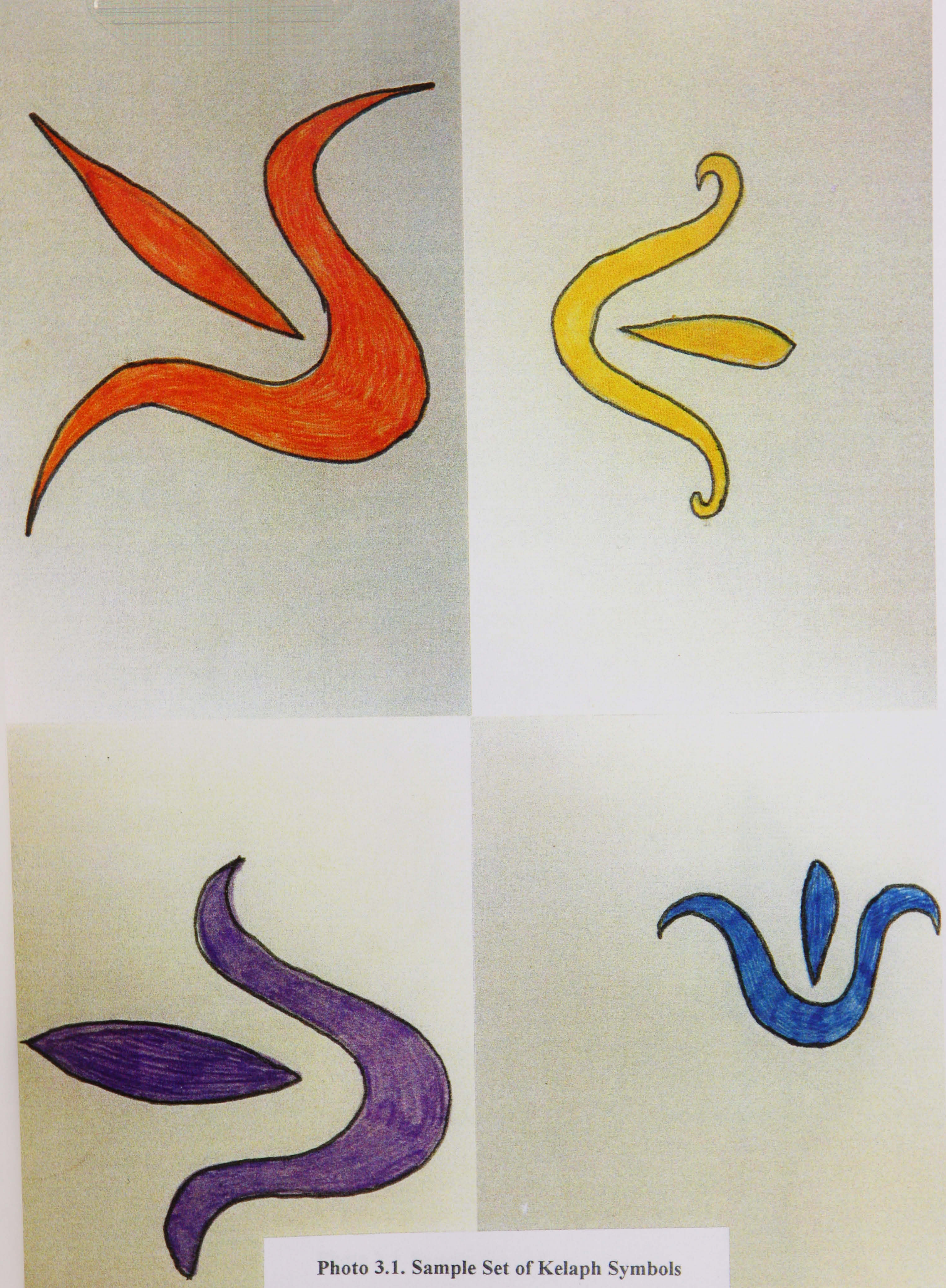


Photo 3.1. Sample Set of Kelaph Symbols

Photo 3.2. Sample Set of Bareg Symbols

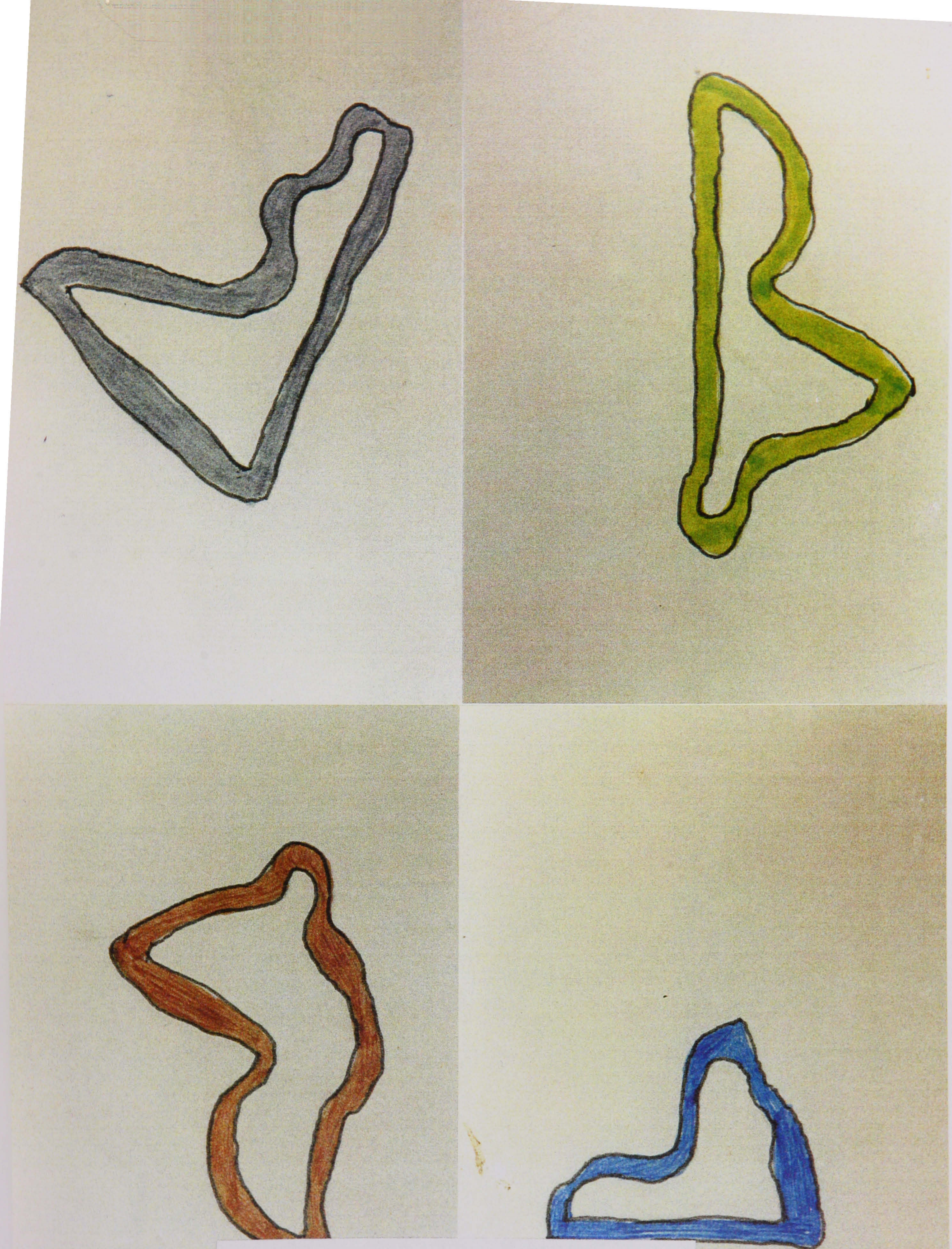
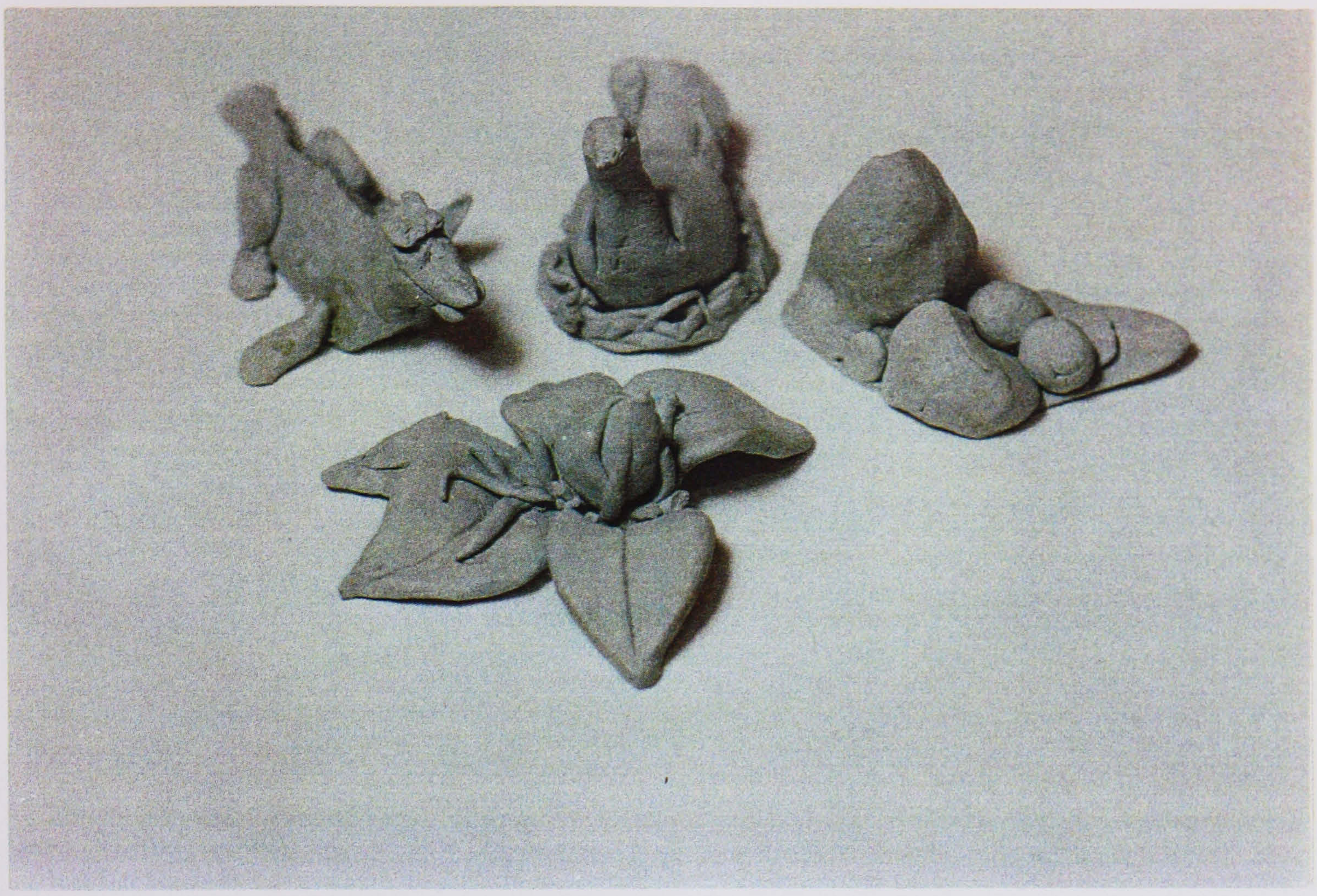


Photo 3.3. Sample Set of Rock Symbols

Photo 3.4. Sample Set of Monster Symbols

Photo 3.5.A. Sample Set of Clay Models



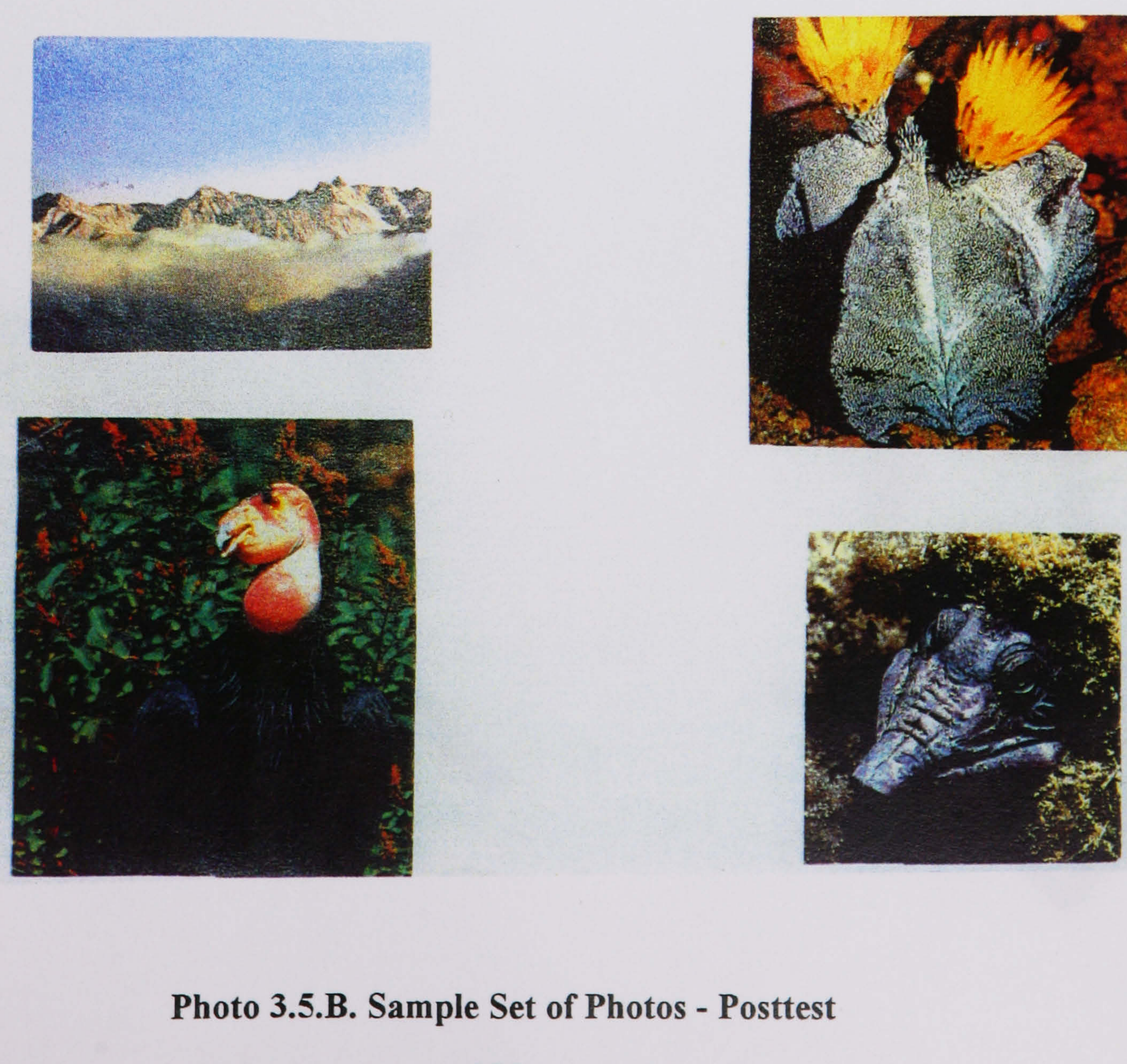
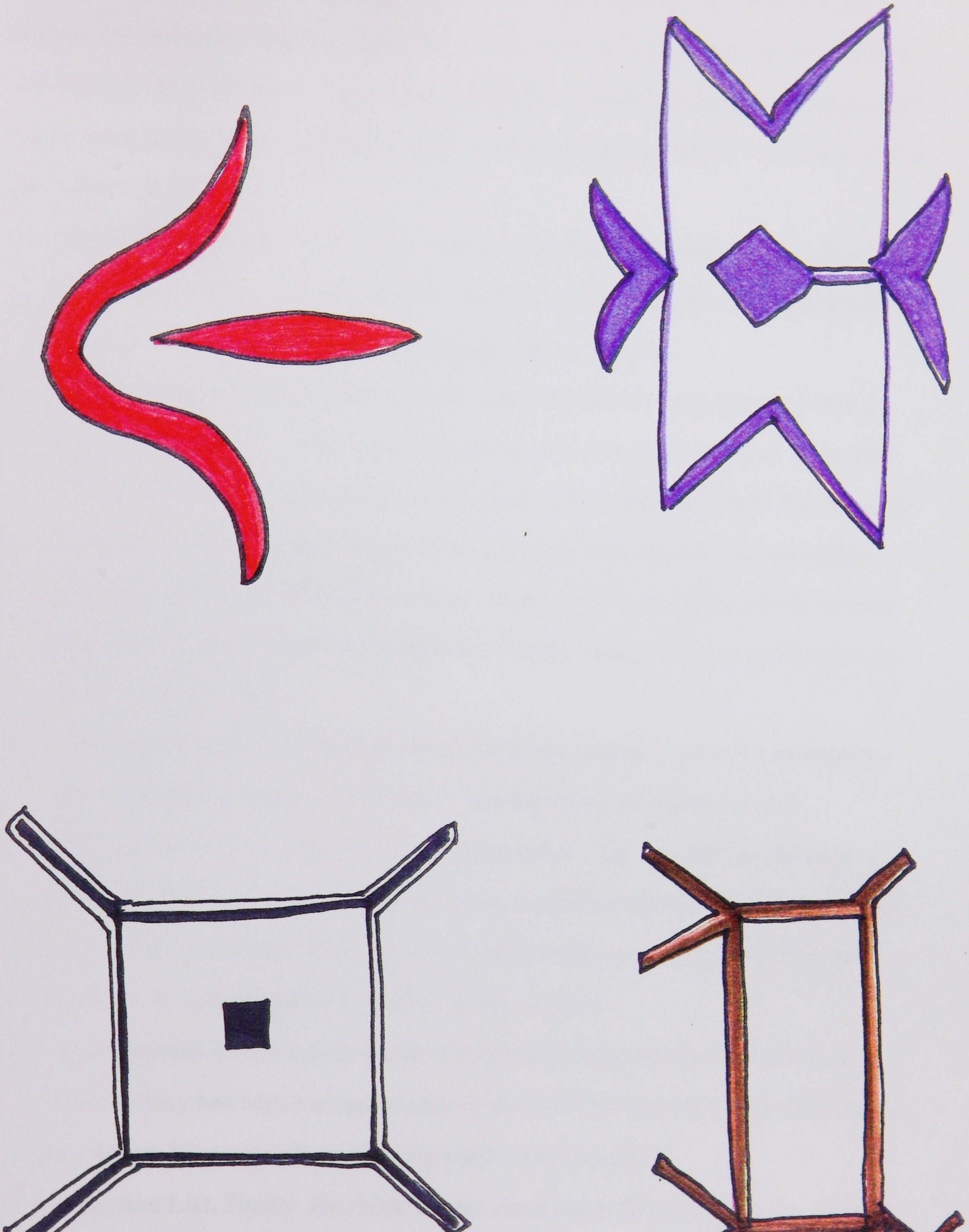


Photo 3.5.B. Sample Set of Photos - Posttest

Photo 3.6. Sample Set of Symbols in Test 4



The Posttest

In the posttest, which took place six to eight weeks after the actual testing, the children were presented with five tasks. First, they were read a short text about the Pimas (see Appendix B, p. B1-B3), in which they heard each new plant name once: Kelaph, and another plant name, Asta, which they had never been exposed to before. The children were then tested with five tests:

1) **Symbol Comprehension Posttest.** They were presented with the symbols that were used in the actual testing and asked to sort them and hand them to the experimenter as they were named in the order: Rock, Kelaph, Bareg, Monster.
2) **Object Comprehension Posttest.** In this test, the children were presented with a layout of four photos, each of which, they were told, was a photo of one of the four objects that they encountered in the story in the actual acquisition task. The layout of four photographs showed a monster-like creature (a Gila monster), an unfamiliar flowering desert plant (a Kelaph), a bird (a Bareg), and rocky hills, and the children were asked to show, in the following order: Kelaph, Bareg, Monster and Rocks (see Photo 3.5.B., p. 156a).
3) **Production Post List.** In this test, the children were asked to name the referents by naming the photos used in Test 2 above. The experimenter pointed to each photograph in the same order as in Test 2 and asked: "Can you tell me the name of this one?" This is the first time during the whole experiment that the children see the photos of the real things. When they were asked earlier to name the referents, they had either been presented with symbols or clay models.
4) **Generalisation.** In this test the children were asked about another new plant name, Asta, that they had been exposed to once in the brief text that was read to them before the Posttest: "Can you tell me what the word "Asta" means?"
5) **Production List.** Finally, the children were asked about the names of some plants that the Pimas used, and also if they could name some plants that grow in their area.

Results.

I will now discuss the data analysis for the experiment, first quantitatively and then qualitatively/descriptively.

A Quantitative Analysis of the Data.

The tests were designed to test for sense, denotation, and reference of the new term, "Kelaph." Quantitative analysis of the data was based on calculations of the raw 1/0 scores from the test performance of each child. Statistical tests, such as Chi-squares, t-tests, Anovas, Mean Tables, and Duncan Multiple Ranges Test were run. Analysis focuses on effects of Age, Sex, and Type of Intervention.

The tests revealed Age only in Test 1 and Test 3, i.e. in the tests of Sign Comprehension and Production. There were children who reached a full mapping of the new term in all groups and in all conditions. Age had a greater effect in the test of Production, in which children were asked to name the referent. This was the test in all age groups that gave the lowest scores, and it was intercorrelated with the test for production in the Posttest in which the scores are similarly low. Age was near significance levels but did not attain significance in Test 2 (Object Comprehension), or in Test 5 (Depiction), or in Test 6 (Interpretation).

The result section starts with tables showing characteristics of responses during the Encoding Phase, then patterns of within-children/between-children responses in the Test Phase are shown, followed by individual between-groups comparisons for the different tests together with a correlation matrix for the tests, and, finally, effects of age and condition are presented.

Characteristics of Responses in Encoding.

In the following tables the correct responses to the new term during the Encoding Phase are presented. It should be pointed out, however, that many children in all age groups did not try to give a definition for the word. Category A means definitions of Kelaph as a plant without the children relating it to something else outside the story by description or to some linguistic or nonlinguistic context within the story and the experimental setting; Category B means definitions of Kelaph related to the story context by mentioning the word in relation to some part/parts of the sentential contexts or to part/parts of the story or to events in the story or to the experimental setting and Category C means definitions of Kelaph related to something linguistic and/or nonlinguistic outside the story. (See Table 3.3. and 3.4., p. 160).

Table 3.3

Indirects - Correct Responses during Encoding

Age	S1	S2	S3	Test1
4	7	7	7	8
6	8	6	7	8
8	6	12	9	8
10	6	8	13	14

N=64

Table 3.4.

Metalinguistic - Correct responses during Encoding

Section 1

Age	A	B	C	Test 1
4	0			
6	0			
8	0			
10	0			

Section 3

Age	A	B	C	Test 1
4	0			6
6	0			6
8	2	1		7
10	1	3		8

N=64

(Test 1 in all these tables is Test 1 from the test phase.)

Patterns of Within-Children/Between-Children Responses.

In order that the patterns of within-children/between-children responses can be estimated, I decided to show these responses in terms of the raw scores and then to calculate the percentages of the possible total scores for each condition at each age level. in which N = 16. Results from T2 (Object Comprehension), T3 (Production), and T5 (Depiction) have been presented in the following bar graphs (Fig. 3.1., 3.2., 3.3., p. 162-164). Results from each of the other tests in the Test Phase can be seen in Appendix B in Table B.1., p. B5, accompanied by bar graphs, Fig. B.1., B.2., B.3., p. B6-B8.

Figure 3.1.

Percentages of Correct Responses for Age and Condition.

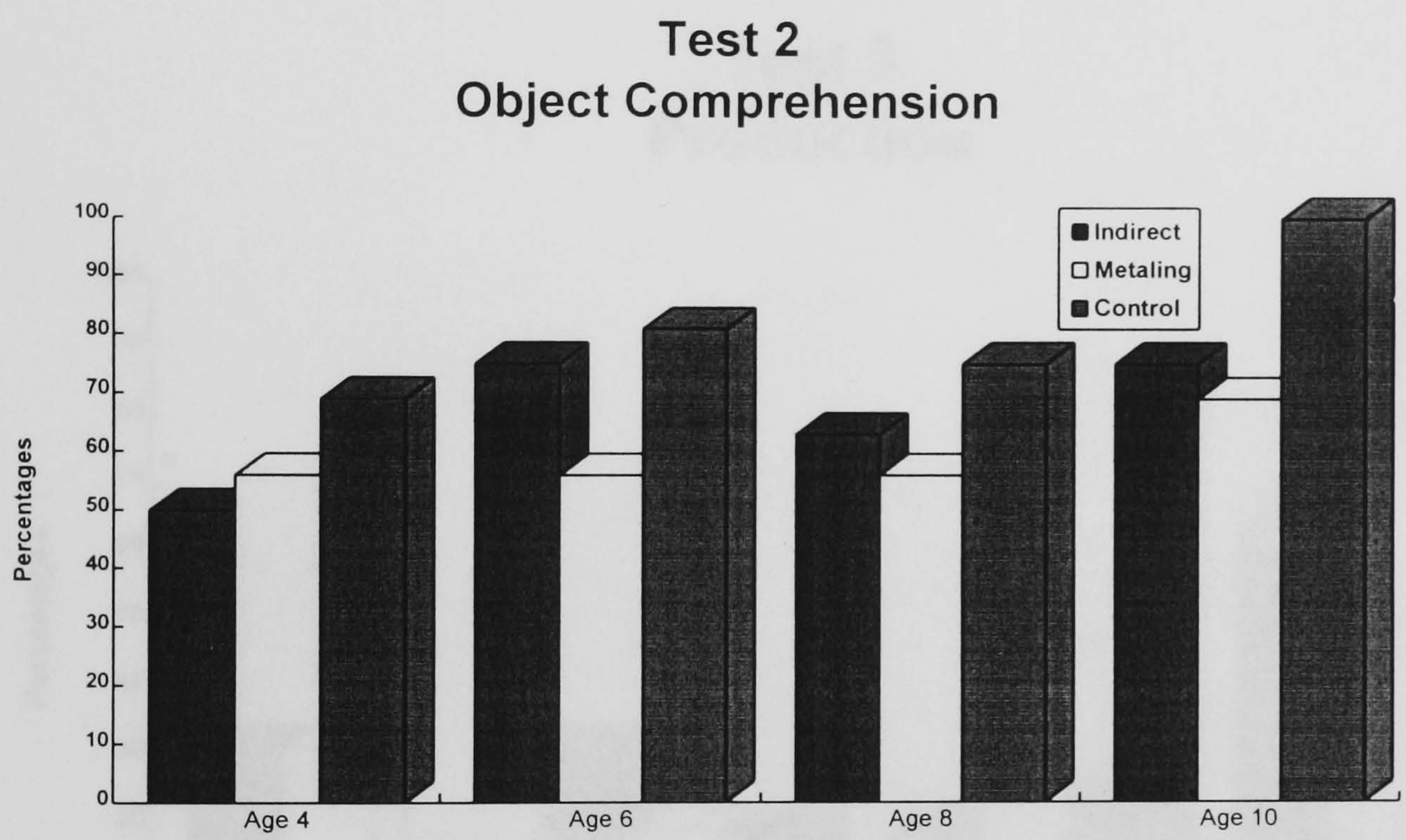


Figure 3.2.

Percentages of Correct Responses for Age and Condition.

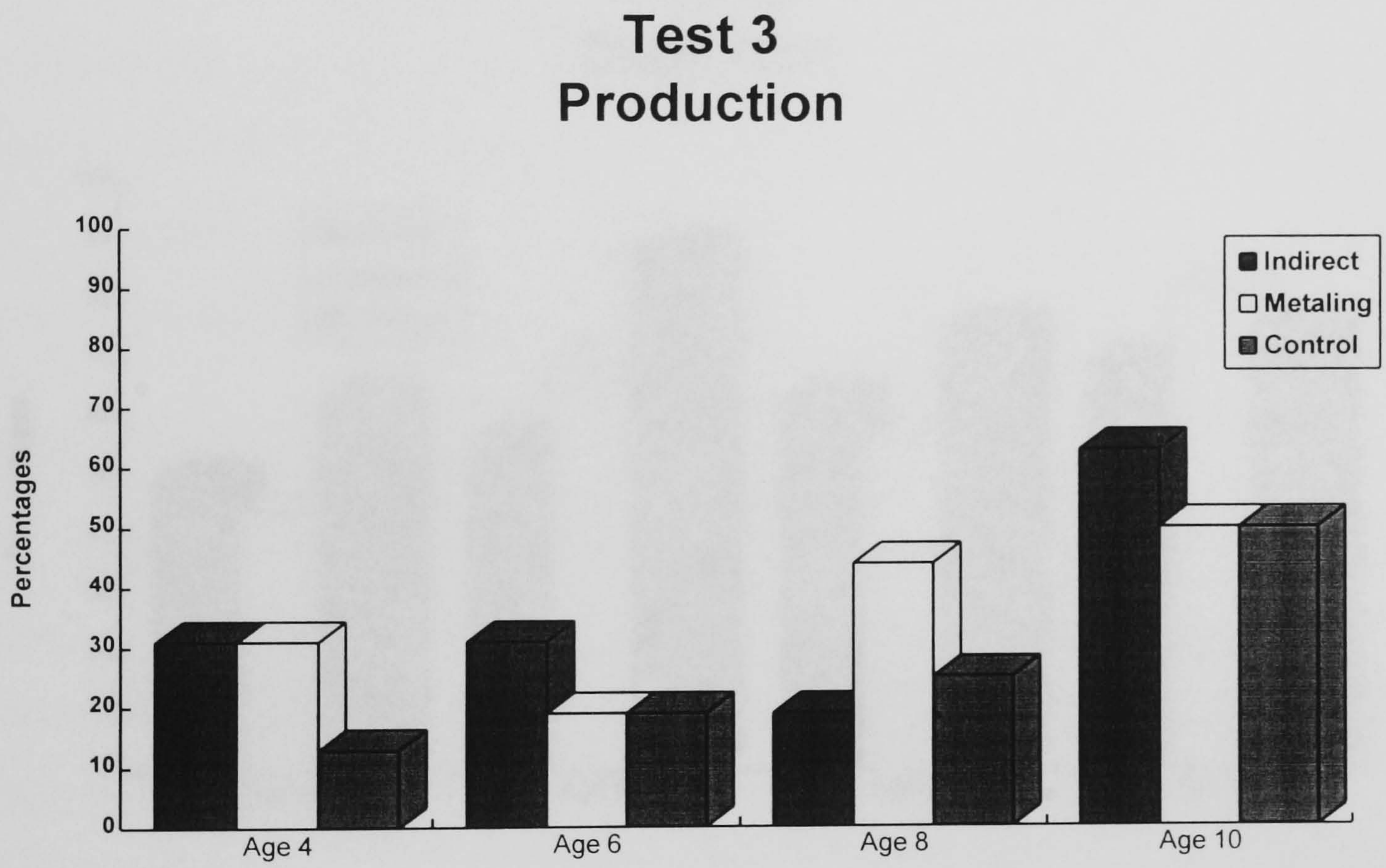
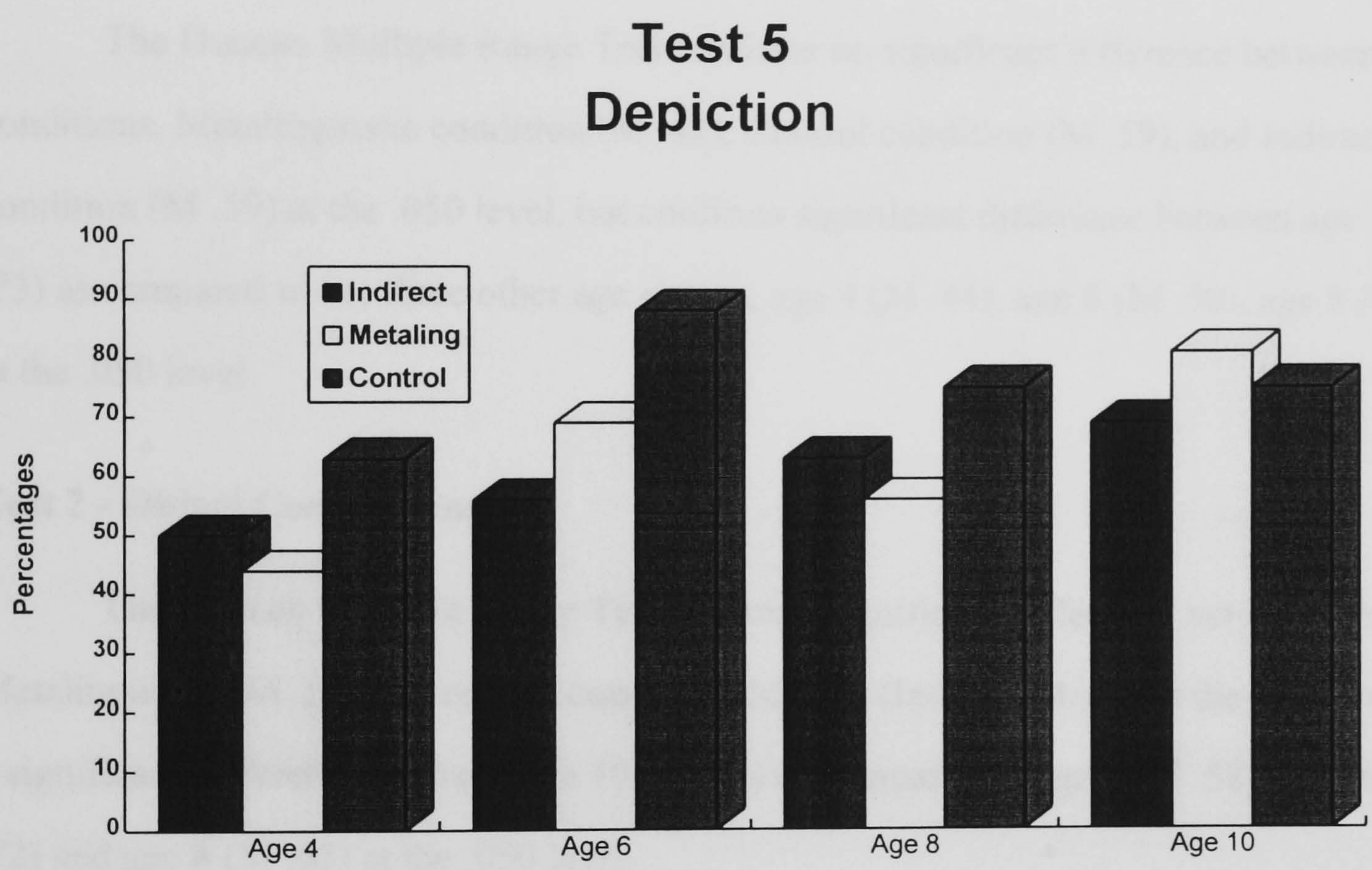


Figure 3.3.

Percentages of Correct Responses for Age and Condition.



Individual Between-Groups Comparisons for each Test in the Test Phase.

The different tests reveal interesting age-related developmental variations in the sample and the effects of different encoding procedures: by using individual between-groups comparisons, employing the Duncan Multiple Ranges Test, the significance in performance is confirmed between the conditions and between the ages for the various tests in the Test Phase.

Test 1 - Sign Comprehension

The Duncan Multiple Range Test confirms no significant difference between the conditions, Metalinguistic condition (M .42), Control condition (M .59), and Indirect condition (M .59) at the .050 level, but confirms significant difference between age 10 (M .73) as compared to the three other age groups, age 4 (M .44), age 6 (M .50), age 8 (M .48) at the .050 level.

Test 2 - Object Comprehension

The Duncan Multiple Range Test confirms significant difference between the Metalinguistic (M .59) and control condition (M .81), (Indirect M .66) at the .050 level and a significant difference between age 10 (M .81) as compared to age 4 (M .58), (age 6 M .72) and age 8 (M .65) at the .050 level.

Test 3 - Production

The Duncan Multiple Range Test confirms no significant difference between the conditions, Metalinguistic (M .34), Control (M .27), and Indirect (M .33) at the .050 level, but confirms significant difference between age 10 (M .54) as compared to the three other age groups, age 4 (M .21), age 6 (M .23) and age 8 (M .27) at the .050 level.

Test 4 - Discrimination

The Duncan Multiple Range Test confirms significant difference between the Control condition (M .75) as compared to the Metalinguistic (M .55) and Indirect condition

(M .58) at the .050 level, but no significant differences between the four age groups, age 10 (M .71), age 8 (M .60), age 6 (M .60), and age 4 (M .58) at the .050 level.

Test 5 - Depiction

The Duncan Multiple Range Test confirms no significant difference between the conditions, Indirect (M .59), Metalinguistic (M .63), and Control condition (M .75) at the .050 level, but a significant difference between age 10 (M .75) and age 4 (M .52) (age 6 M .65 and age 8 M .71) at the .050 level.

Test 6 - Interpretation

The Duncan Multiple Range Test confirms significant difference between the Indirect (M .42) and Control condition (M .66) (Metalinguistic condition M .48) at the .050 level, and a significant difference between age 8 (M .60) and age 4 (M .38) (age 6 M .718, age 10 M .75) at the .050 level.

(See Appendix A, Table A.2., p. A15 for subsets for condition and age for T1-T5 with the Duncan Multiple Ranges Test).

The following **correlation matrix** (see Table 3.5., p. 167) shows strong **correlation** *among some of the tests:* the strongest correlation among Test 5 (Depiction) and Test 6 (Interpretation) (.67**); among Test 4 (Discrimination) and Test 5 (Depiction) (.55**); then, among Test 1 (Symbol Comprehension) and Test 2 (Object Comprehension) (.43**); among Test 1 (Symbol Comprehension) and Test 3 (Production (.40**), and, finally, among Test 5 (Depiction) and Test 2 (Object Comprehension) (.39**). (See more in Discussion on the revelations of the tests, p. 197-198).

Table 3.5

Correlation Matrix for the Tests in the Test Phase

Correlations:	SICOM	OBCOM	PROD	DISC	DEPIC	INTER
SICOM	1.0000	.4324**	.4014**	.3371**	.3388**	.2374**
OBCOM	.4324**	1.0000	.2848**	.2437**	.3874**	.2306*
PROD	.4014**	.2848**	1.0000	.2205*	.3223**	.2868**
DISC	.3371**	.2437**	.2205*	1.0000	.5493**	.3338**
DEPIC	.3388**	.3874**	.3223**	.5493**	1.0000	.6668**
INTER	.2374**	.2306*	.2868**	.3338**	.6668**	1.0000

N of cases: 192   2-tailed Signif: * - .01 ** - .001

Effects of Age and Condition on Performance.

The following is Two-Way Analysis of Variance (Two-Way Anova) showing the effects of Age and Condition on the different tests in the Test Phase. Anova tables and Mean tables for these tests are presented in Appendix B in Table B.4., p. B14-B18 and Table B.5., p. B19-B24.

Test 1 (Symbol Comprehension)

Two-way Analysis of Variance (Two-way Anova) shows significant main effects of Age, $F\ (3,180) = 3.43$, $p < .05$. Age group 10.5 performed best overall. Age groups 6.5 and 8.5 performed best in the Control condition, and age groups 4.5 and 10.5 performed best in the Indirect condition.

Test 2 (Object Comprehension)

Two-way Anova shows significant main effects of Condition, $F\ (2,180) = 3.86$, $p < .05$. Age group 10.5 performed best overall. All age groups performed best in the Control condition.

Test 3 (Production)

Two-way Anova shows significant main effects of Age, $F\ (3,180) = 5.63$, $p = .001$. Age group 10.5 performed best overall. Age groups 4.5 and 8.5 performed best in the Metalinguistic condition and age groups 6.5 and 10.5 performed best in the Indirect condition.

Test 4 (Discrimination)

Two-way Anova shows significant main effects of Condition, $F\ (2,180) = 3.28$, $p < .05$. Age group 10.5 performed best overall. All age groups performed best in the Control condition.

Test 5 (Depiction)

Two-way Anova shows that neither Age nor Condition are significant for performance in Test 5. Age group 10.5 performed best overall. All age groups performed best in the Control condition except age group 10.5 performed best in the Metalinguistic condition.

Test 6 (Interpretation)

Two-way Anova shows significant main effects of Condition, F (2,180) = 3.96, $p < .05$. Age group 8.5 performed best overall. All age groups performed best in the Control condition except age group 4.5 performed best in the Indirect condition.

Combined Tests.

The following are combined tests, the results of which have been calculated from the means of each of a given subtest: (T1: Symbol Comprehension, T2: Object Comprehension, T3: Production, T4: Discrimination, T5: Depiction, and T6: Interpretation) in the Test Phase (see p. 148-150 for full description of each of the tests). The results of three such combined tests are presented here. These tests have been named *Full Meaning, Insight*, and *Comprehension.* It should be noted that the names of these combined tests indicate that in *Full Meaning*, a child who has all the subtests correct has worked out the full meaning of the new term as s/he has mastered both the comprehension and production of the new term; whereas a child who has one or more of the subtests wrong has only a partial meaning for the new term. In *Insight*, only the tests of Depiction (T5) and Category (T6) are included and a child who has both of these correct can be granted with both linguistic and non-linguistic knowledge of the new term. In *Comprehension* the test of Production (T3) has been omitted, and as the remaining five tests are testing for comprehension and a blend of linguistic and non-linguistic knowledge, a child who has all five of them correct can be granted with a general understanding of the new term and with some linguistic understanding--but not a full meaning yet--as s/he has difficulties in recalling it, a procedure that may be of a more semantic content than the one of *Comprehension.*

Full Meaning (All tests, T1 - T6).

Two-way Anova shows significant main effects of Age, F (3,180) = 4.39, $p = .005$ and of Condition, F (2,180) = 3.25, $p < .05$. Age group 10.5 performed best overall. All age groups performed best in the Control condition.

Insight (Test 5 + Test 6).

Two-way Anova shows significant main effects of Condition, $\underline{F}$ (2,180) = 3.47, $\underline{p}$ <.05. Age groups 6.5, 8.5 and 10.5 performed quite equally overall. All age groups performed best in the Control condition.

Comprehension (Tests 1, 2, 3, 5 and 6. All Tests except Test 4 - Production)

Two-way Anova shows significant main effects of Age, $\underline{F}$ (3,180) = 3.25, $\underline{p}$ <.05 and of Condition, $\underline{F}$ (2,180) = 5.11, $\underline{p}$ <.01. Age group 10.5 performed best overall. All age groups performed best in the Control condition.

The following graphs (Fig. 3.4., 3.5., 3.6., p. 171-173) present effects of age and condition on performance in Full Meaning (T1-T6), Insight (T5+T6) and Comprehension (T1+T2+T3+T5+T6).

Results from the posttests can be seen in Appendix B (p. B13) together with Anovas and Mean Tables for all tests in Test Phase and Posttesting (Table B.4., p. B14-B18 and Table B.5., p. B19-B24).

Figure 3.4. Effects of Age and Condition on Performance in Full Meaning

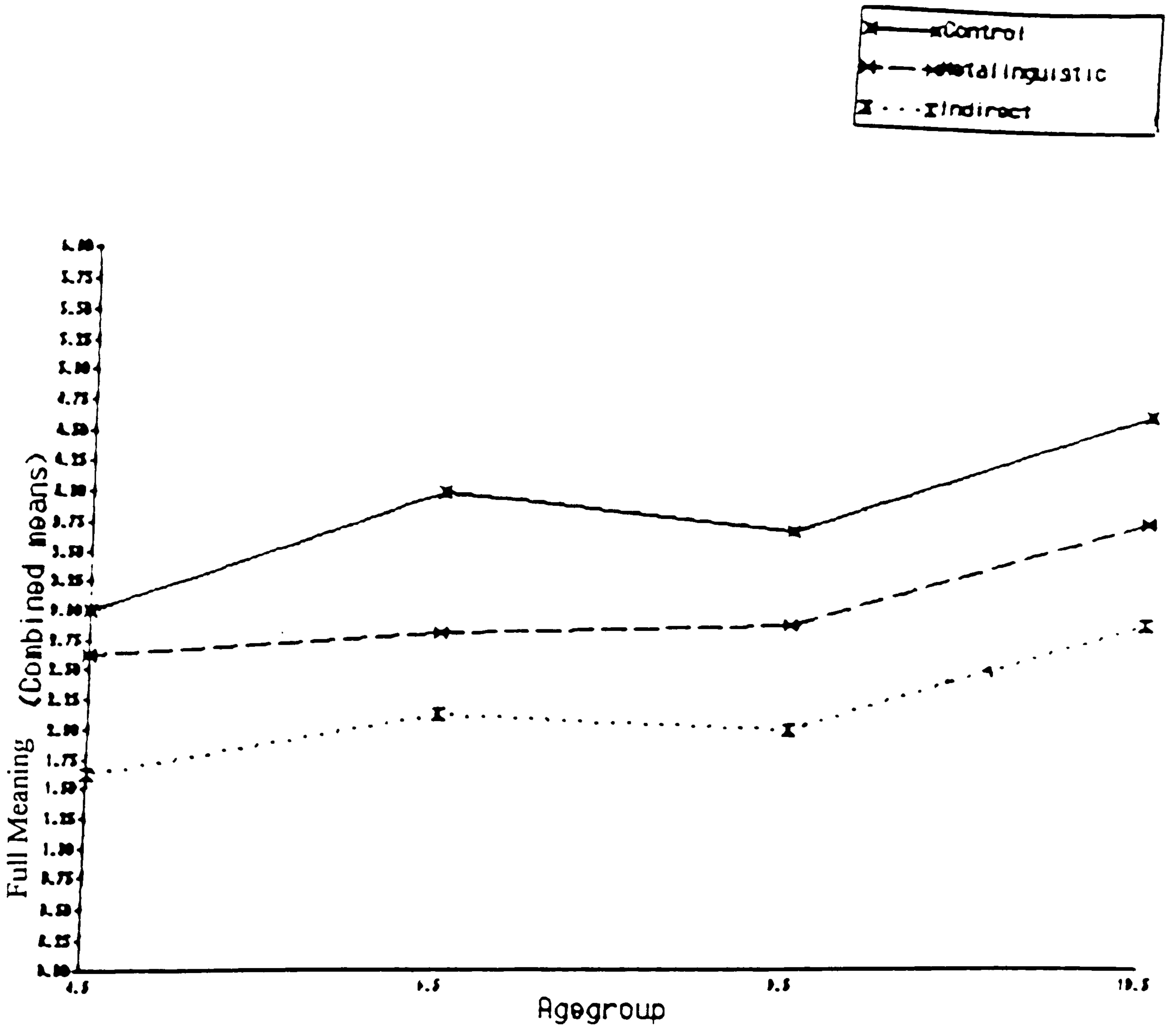


Figure 3.5. Effects of Age and Condition on Performance in Insight

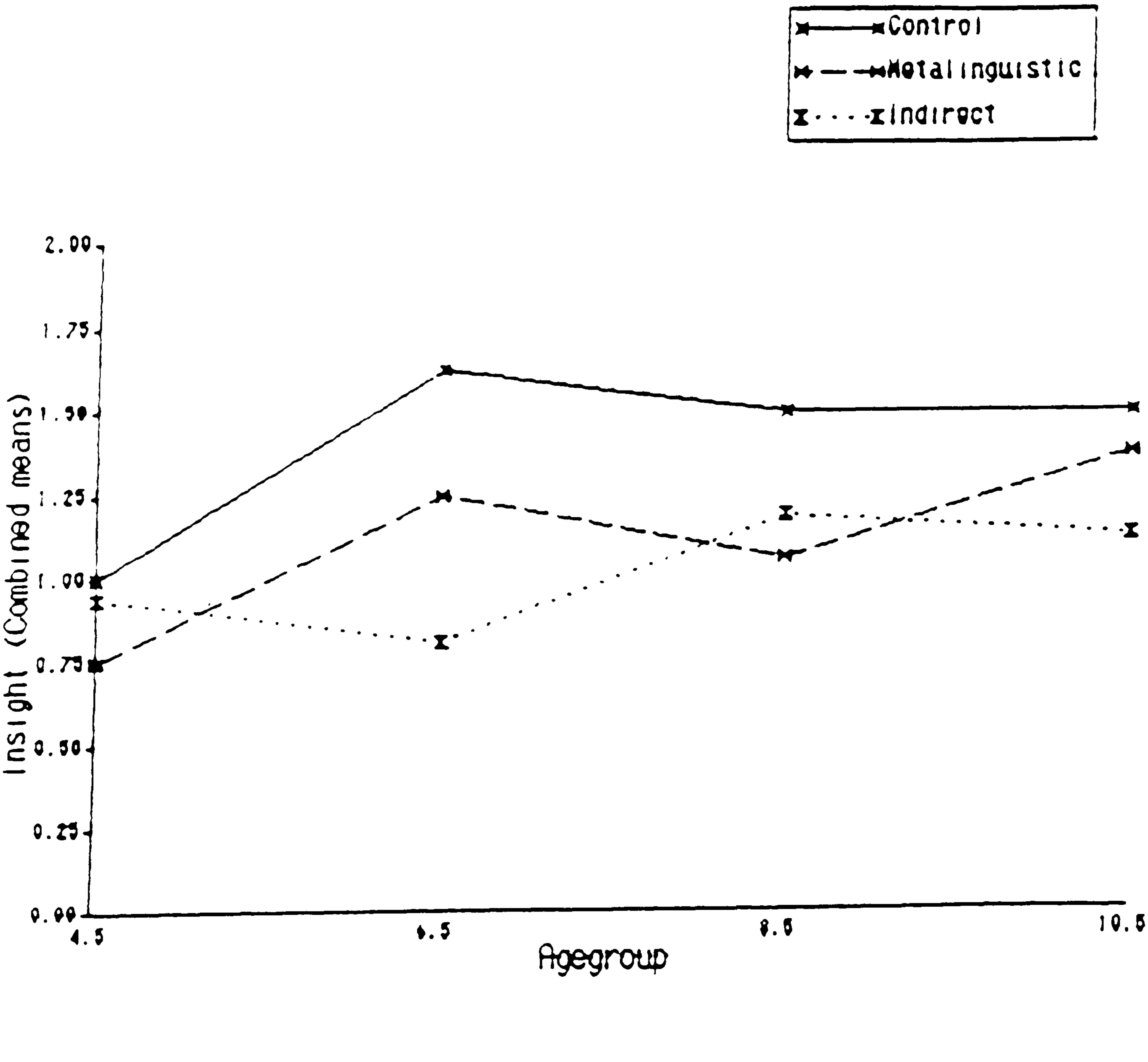
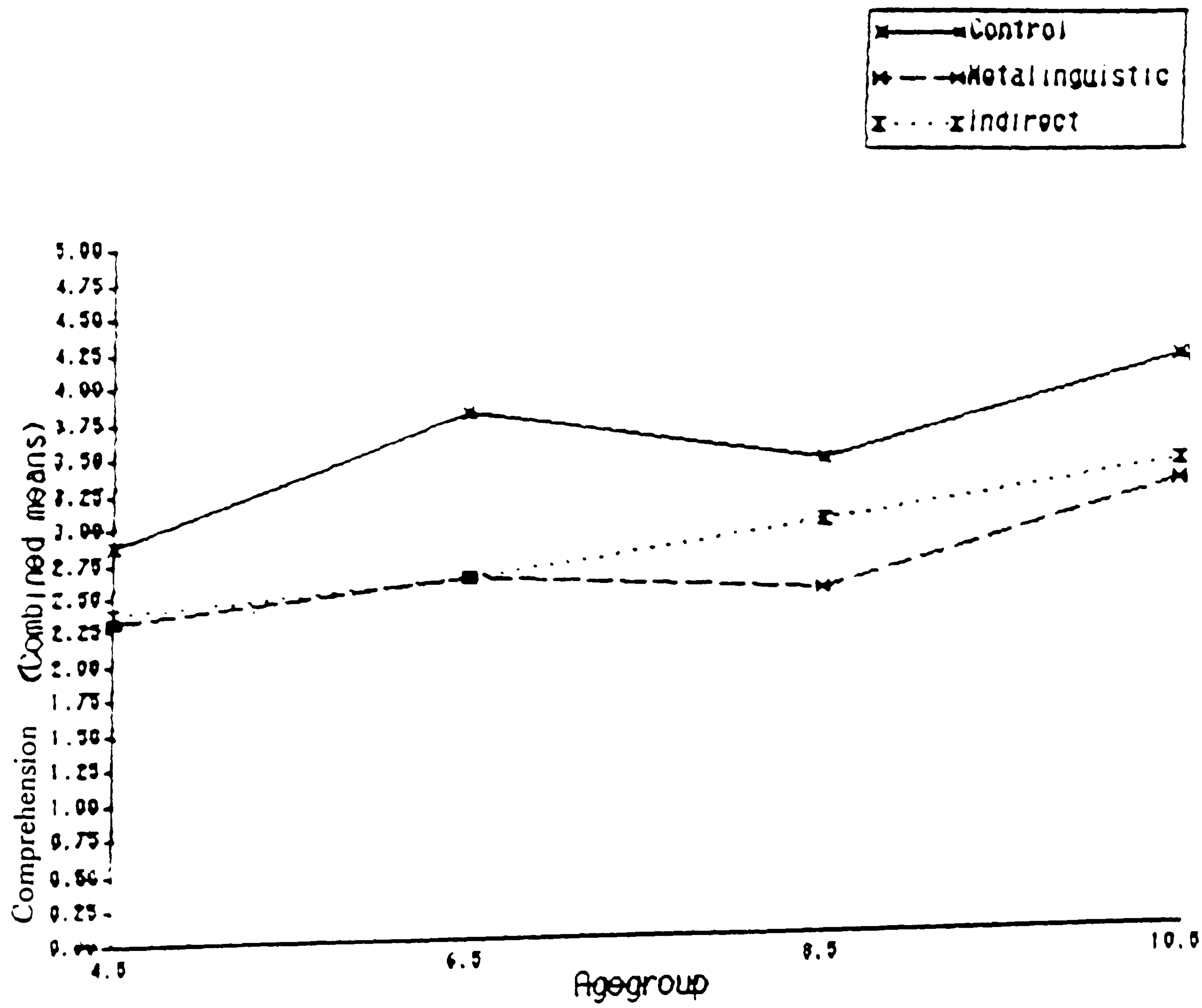


Figure 3.6. Effects of Age and Condition on Performance in Comprehension



A Qualitative Analysis of the Data.

I now describe the data in the experiment qualitatively and take, as my starting point, the concept of resemblance and its connection to the issue of incidental learning. Words not only have associations that users can articulate if they have the necessary memory and application, they also seem to form secret or hidden connections in the unconscious levels of the mind. Joos (1972) has stressed the use that hearers make of resemblance in their intuitive behaviour when they are deciphering the meanings of new words. The word as symbol stands for something such that, when it is noticed through sight or hearing, the thought of it comes to mind. Words as symbols for thoughts do not maintain a strict one-to-one relationship with the things symbolised.

Intersubjectively demonstrable sensory experience provides the basis for much linguistic patterning. Resemblance, in this jargon, is thought of as a structural aspect of sense experience. William James (1890) argued for resemblance (similarity) as the cornerstone of logic in regard to both classification and inference. Von Slagle (1974) has described resemblance in the following manner:

> Resemblance, it seems reasonable to assert, constitutes the basis of all categorisation. Thus, for example, when we say silver is a metal or Fido is a dog, we are categorising on the basis of criterial modes of similarity which must be fulfilled in order to correctly label such phenomena according to the semantic code of the English speech community (p. 34).

Roger Brown (1957) has pointed out that if a semantic map is to be oriented, it must be oriented in terms of intersubjectively demonstrable sensory experience. Brooks (1978) and later Kemler-Nelson (1984) have both argued for family resemblances as the basis for much incidental learning. Brooks has maintained that this mechanism is important when people process complex material such as the one of language in textual interpretation. Resemblance is given in immediate perceptual experience. Von Slagle (1974) further contends that we classify the three most important classes of denotata--substances, attributes, and relation--on the same basis--in terms of modes of resemblance. In his terminology, "substances" are things such as houses, trees, and ships, "attributes" are categories such as size, shape, colour, weight, and "relations" are experiential correlations of concepts such as resemblance, causality, before, after, weak and strong. The immanent organisational factors of perception have been regarded as the immanent organisational factors of thought. Concepts are thought of as "rules" of perceptual organisation and as the ultimate constituents of the constructs of the imagination are thought to be derived from sense experience. The function of similarity or resemblance is regarded as a principle of spontaneous grouping in sensory fields and can be related to the function of similarity as the basis of classification and recall.

Werner (1948) spoke of "physiognomic perception" as a process of subsuming experiences which, he maintained, is a process that children adhere to in their early perceptual organisations. Joos (1972) has spoken of a resemblance process when people decipher the meanings of unknown words within a given text. Errors are always involved. Donald Schon (1963) pointed out the significance of errors in restructuring that happens in the understanding of metaphor, metaphor being based on resemblances, analogies:

> Error functions as a guide to discovery. Misapplication of a theory, based on a partial misapprehension of what is in the situation, guides us of the theory as a projective model for the situation. Children thrive on a similar process. They call a croquet mallet a bat; they proceed to discover, through a variety of experiences, how it is not a bat; but in the meantime their notion of a bat, and of games in which a bat is used, serves for them as a projective model for playing croquet. The transition from erroneous application of the *old theory* to its displacement is part of what gives continuity to their learning. And, since their first identification of the situation is never wholly erroneous, the error assures them of some appropriateness in their choice of metaphor (p. 71).

I will, in what follows, give a descriptive account of the observed processing that children in each condition in Experiment 2 underwent. A light will be cast on Joos's hypothesis that I have stated earlier in this thesis, that: a) children make use of certain contextual determinants without thinking logically or consciously about them when they are learning the meaning of a new term; b) interferences in this process lead the children astray; c) result in erroneous mappings, and d) from which recovery can be problematic for the children.

Memory for instances for the children in the study is more natural than for them to work out consciously the general rules governing the meaning of the new term, "Kelaph." Often these memories are based on pieces of valuable information from the linguistic and/or non-linguistic context, and there are many children, even if making errors, who are not totally erroneous in their inferences and progress towards a proper mapping of the meaning of the new word.

The Indirect Condition.

The non-linguistic and linguistic context in which a child learns a word will make a difference in his or her first hypotheses about the word. Linguistic information in the input can thus lead the child either toward or away from contrasting a new and an old word. The fact that the child develops non-linguistic concepts separate from language can influence the course of linguistic development. If the child discovers, for example that items such as cats and cows belong to separate categories or that Kelaph and daffodil belong to separate categories, s/he may look for separate words to label those categories. The children brought to the experiment their own non-linguistic biases and predispositions. It has been found (Merriman, 1986), that children prefer to apply a novel term to an unfamiliar token of a type, for which they had a name, over applying it to a familiar token of a type, for which they had no name. This phenomenon is reflected in children when they ignore explicit contrast information in the input but respond on the basis of their preferences for attaching words to one type of meaning over another instead of relying on the information in the input to form their hypotheses about the meaning of the new word.

The situation in which the Indirect children were placed was, to some extent, structured by the question: "Can you hand me the 'X'?" This helped the children to set up a semantic frame. The presence of objects helped the older children to establish reference and hence to develop subsequent meaning. On the other hand, too many unknown symbols and too many unknown objects were a confusion for the younger children. This condition gave the most practice for the children to work out the extension of the new concept, Kelaph. It provided contact with the stimuli materials of symbols from the start of the experiment to Test 1, Sign Comprehension.

In a contrasting situation, children handed over the strange object emphasised by the lexical contrast. But a different picture emerged in the experiment when there was more than one unknown object employed, such as Kelaph and Bareg, and the children had to choose between them. As the new term was a noun, the children were aware that the denotatum was likely to be an object that was not going to change to any significant degree in the course of the experiment. After a few subsequent requests in the Encoding Phase and the Test Phase, many children had developed a stable mapping of the meaning of the new term.

The 4-year-olds made several mismatches and showed confusion. Many spoke aloud when they were grouping the symbols. Some spoke of counting the symbols and spoke aloud about what they were going to do with them. Some stuck to their error all through the sections. The most common mistake was to choose the Bareg for Kelaph. Quite a few of the children were even incorrect in all three sections in the Encoding Phase on all the symbols. But there were also confusions between Baregs and Monsters. Quite a few young children wanted affirmative answers from the experimenter and said: "That's like this, isn't it?", "Isn't it?" was often asked.

The 6-year-olds commonly had all four referents wrong in all sections in the Encoding Phase. Also, they mistook Bareg for Kelaph. Some had three out of four symbols incorrect, with Rock being the symbol most correctly identified. However, there were children who realised their error, and if they had made a recovery already in the sections, they did well in the Test Phase also.

The 8-year-olds were often already correct on Kelaph after the first section. Still there were children who were not correct on Kelaph until in the last section; this was the case with a few children in the two younger age groups. The following is an example of Indirect testing with Mary (age 7.8):

Section 1.

Is quick at grouping the signs and does so correctly.

Gives Rocks correctly.

Gives Monsters for Kelaphs.

Gives Kelaphs for Baregs.

Gives Baregs for Monsters.

Section 2.

Gives Baregs for Monsters.

Gives Kelaphs for Baregs.

Gives Monsters for Kelaphs.

Gives Rocks correctly.

Section 3.

Gives Monsters for Kelaphs.

Gives Baregs for Monsters.

Gives Rocks correctly.

Gives Kelaphs for Baregs.

Test 1.

Gives Rocks correctly.

Gives Monsters for Kelaphs.

Gives Kelaphs for Baregs.

Gives Baregs for Monsters.

Test 2.

Matches Monster models with Bareg symbols and Bareg models with Monster symbols.

Points to the Rocks correctly.

Points to the Bareg (models) for the Kelaphs.

Points to the Kelaph (models) for the Baregs.

Points to the Monster (models) correctly.

Test 3.

These are the Rocks.

These are the Bars for Kelaphs.

These are the Monsters.

These are the Kelophs for Baregs.

Test 4.

Points to the Butterfly symbol for Kelaph.

Says "Something like a donkey or a cow" for the deer.

"The Bar- one," she says for the Kelaph.

"A square," for the spider.

Test 5.

E: Can you now draw me a Kelaph?

S: Draws the monster symbol.

E: Is this the Kelaph symbol?

S: Yes.

Test 6.

E: What do you think a Kelaph is?

S: I think it is an animal.

E: Why do you think so?

S: Because when you showed me the pictures of one, it sort of looked like that.

Posttests.

Test 1.

Shows Bareg for Kelaph.

Shows Kelaph for Bareg.

Shows others correctly.

Test 2.

Shows Bareg for Kelaph.

Shows Kelaph for Bareg.

Shows others correctly.

Test 3.

Says Bar for Kelaph.

Says Keloph for Bareg.

Others correct.

Test 4.

Don't know for Asta.

Test 5.

Cactus, snowdrop, thistle, daffodil.

The 8-year-old children, when they were first asked to hand over Kelaph, often asked: "What is a Kelaph?"; whereas few of the younger children asked such a direct question. However, there were still children in this age group who repeated their mismatches, usually by confusing Kelaph and Bareg in both the Encoding and the Test Phases.

The 10-year-olds, after having mismatched Kelaph for one of the other referents after the first section, realised their mistake and corrected themselves. They showed surprise when they heard the words "Kelaph" and "Bareg" from the experimenter, after the first section, when they were asked to hand these over. They remarked: "What?" or "What does it mean?" There were children who were correct on the Kelaph symbols and on all the other symbols also in all the sections and could even say the word "Kelaph" properly. However, there were children who were wrong in two out of three sections on Kelaph. Handing over the Bareg for Kelaph was the most common error pattern.

The Metalinguistic Condition.

The rationale behind the Metalinguistic condition is that children's erroneous responses and their general comments about their tasks are often as informative as their correct responses. Cases here show that even if children were not performing properly, many of their responses attempted to draw on the linguistic information presented in the sentences in the story. They said, for example: "This red stuff to dye the skins of the little deers" (Anton, age 6;3). The important point is that few of these responses were semantically empty. When the children made incorrect responses, there was often an underlying pattern. They had difficulty in completing their tasks, even if they demonstrated semantic competence in other ways. They were required to reflect on the linguistic input in a metalinguistic manner--forced to pay attention to the word that implies an awareness that they may not have until a later age. They had to make an initial decision after a minimal presentation of specific linguistic information. They had to integrate a series of guesses about the meaning of the new word. The emphases was on conscious deduction and inference. The interpretation of several sentences required a more abstract approach to language and to words than lay within the capabilities young children can consciously employ. Besides, the interpretation may have taken place at tacit levels of understanding that were not accessible to young children.

There were cases in which the children repeated a single response throughout the series of sentences. They may be said to have grasped the "nature" of the task--that the responses to the sentences were somehow related. There were attempts to integrate the repetition with the preceding sentence such as Robert's (age 8.3): "I have never heard of a Kelaph before, but it must be some sort of plant they crushed for bandages." After the last section, the same child recalled that the Pimas used the tough juices of Kelaph to engrave shells and said: "It's a desert plant tree." When he was asked to connect his definitions, he said: "It must be some kind of a flower that they grow."

The appropriate interpretation was often governed by the new situation and by the old information. The incident was salient to the children and the next encounter with the new word could bring to mind two associations. Also, there were attempts by the children to make sense of the problem by using associations that had originated in their own experiences. Some of these attempts were more appropriate than others, such as saying, like Christine (age 9.7) did in Section 1: "They used Kelaphs like berries to dye things." In Section 2, she said: "It could be Keila that they used." In Section 3, she said: "The hard skins, the rough Kelaph skins." When she was asked to piece together the information that she had given, she brought in her background knowledge, which led her astray and gave this definition of Kelaph: "The blood of some buffalo; well, I know they used blood for medicine and berries to dye things."

Some of the children's guesses about Kelaph were more useful than others in their mapping of the meaning of the new word. Especially, if: a) the children remembered the initial presentation in which the word had occurred and b) if they saw the connection between the presentations of the word. However, many children were unable to see the connection between the presentations of the word and to consciously determine the general rule. Instead, they talked about memories of instances, contexts in which they had heard something about the new referent but could not connect the information when asked to do so. This lack of co-ordination may, therefore, reflect the children's inferential abilities in this type of learning situation rather than the children's word-learning abilities. Contextual abilities are the only factors other than perceptual features that Anglin (1977) has found to be important in concept formation. On basis of the children's performance in this condition, it can be argued that the children who had abilities to make use of the given situational context and to make use of the available linguistic context quickly adhered to a self-regulatory process in which they tried intuitively to decipher the meaning of the new word. A noted characteristic was how well they trusted their own contextual skill and ability.

The main strategies that the children used in this condition were: a) a variety of strategies ranging from the primitive use of phonetic information in "slang" associations to correct responses that utilised all the information given in an individual sentence. (There were not many such responses. Saying, as did Martin (age 6.4) that: "Kelaph is ceiling," is an example of phonetic origins and made no sense in relation to the story); b) responses that were solely situation-bound such as mentioning objects in the room where the experiment took place or in the outer environment while being tested. (For example, Lorna (age 6.1) spoke about a picture on the wall in the test room when she was asked about Kelaph. If such responses occurred, they tended to reflect something salient in the testing environment. Type 1 and 2 strategies were of no constructive use to the children. They were not learning anything important about when to use the word or about its possible contextual determinants); c) the issue of contextual determinants was brought forth in one strategy that the children used. Rather than making spurious connections drawn from the physical situation of the testing, there were responses that reflected associations that were (or appeared to be) directly generated from some association with the linguistic elements presented. These associations integrated some aspect of the children's world knowledge and elements within the presented sentence. These responses apppeared to be bizarre if an attempt was made to replace the new term by the children's explanation of it, but the associations were clear. By using this strategy, the children were trying to make sense of the situation. For example, Keith (age 5.9) who could not state anything directly about Kelaph in both Section 1 and 2, said in Section 3: "I heard the shell bit."

The 4-year-olds gave few definitions of words. When they were asked about the new word, they often responded: "A Kelaph is just a Kelaph." Thus, they gave concrete definitions of the new word, more like holistic, unanalysed labels that may have been understood by the children themselves from their point of view but did not pass for proper vocabulary definitions by adult standards. However, there were children who could give very good answers to the questions, as did Susan (age 4.1): (It took some time to get her to come out of her class and to the test room. She took her rag dog, Snoopy with her).

Section 1.

E: Do you know what the word "clan" means?

S: No.

E: Do you know what the word "to scatter" means?

S: Nice, if there is a bit of salve, my mother put some posters up this is my bit and this is little sister's bit (shows the experimenter on the table) that comes first.

E: Do you know what the word "Kelaph" means?

S: Yes.

E: What?

S: Don't know.

Section 2.

Asks the experimenter: "Do you know a dog named Rhea? It's a Labrador.

E. Do you know what the word "Kelaph" means?

S: Kelaphs, yes, don't know what it is. "Kela," she says.

E: Do you know what the word guardian means?

S: (Hesitates).

E: Do you know what it is "to guard someone?"

S: Pause.

E: Does your Labrador dog guard your family? Do you guard your Snoopy?

S: Pause.

E Do you know what it means if something is crushed?

S: I don't like it.

S: I heard the Thunderbird (she remarks, as she hears about the flock of birds in the story accompanying it).

Section 3.

S: We will have some games, won't we? But you need to tidy the table (she says to the experimenter. Talks to Snoopy). He says he knows that this fast bit Kelaph will tell me, he will keep a guard of this one (the Bareg bird).

Test 1.

I don't know what any of them are anyway (she says as she sees the objects). I can only recognise a face and a face, that's all I can recognise (she says about the Bareg).

Gives rock correctly.

Gives Kelaph (this one, she says) correctly.

Gives Bareg correctly

Gives Monster correctly.

("That one looks like a Monster," she remarks)

Gives all items quickly and correctly.

Test 2.

Points to Rock correctly.

Points to Kelaph correctly.

E: Points to Bareg correctly.

Points to Monster correctly.

Test 3.

The hills (for the rocks)

A Monster (for the deer)

A duck (for Bareg)

A Keili (for Kelaph, this word came quite spontaneously)

Test 4.

Shows Kelaph correctly.

Looks like hat.

An arrow for the butterfly.

The Monster for the deer.

S: I think Snoopy is trying (to say). She talks to Snoopy: It has points one, two, three, four points and a one square and one little one in the middle (the spider).

E: What do you say?

S: Snoopy says he doesn't know either.

Test 5.

E: Can you now try to draw me a Kelaph?

S: I am trying to. I show you, what I can make (starts to draw). Draws the sign.

Test 6.

E: What is a Kelaph?

S: I don't know. It had a bang at the top there, that's how it looked like definitely.

S: It must be a plant if I put it over and if I put another side of it.

E: Did the Pima Indians use the Kelaph?

S: Yes.

E: What for?

S: Some hats.

E: Did they use the Kelaphs for a bandage?

S: Yeah. They might have. They were talking about the sea Monster, couldn't it?

E: Did you like the story?

S: He (Snoopy) quite liked it all the way.

Posttests.

Test 1.

Shows all items correctly.

Test 2.

All correct except Kelaph.

Test 3.

Can say Kelaph straight away. All except Bareg.

Test 4.

Doesn't know for Asta.

Test 5.

Kerlagh, daicie, dandelion, jucca, spider plants, a leaf and a flower, a kind of wee flowers.

Other 4-year-old children paused when asked and still others constantly said that they did not know; a few gave completely wrong answers such as : "A man" or "An animal."

The 6-year-olds picked up information from the story context on Kelaph. However, the most common situation was that the information that they had gleaned became coloured with other information that was more outstanding in the text. They said, for example, that Kelaph meant "animal" because of: "This red stuff to dye the skins of the little deers,"(that was spoken of in Section 1). They even said that Kelaph meant "the enemy" or that it was "An Indian name," because they had heard about a bandage in the story that had been made of crushed Kelaphs, and then they had heard about the enemies; therefore, Kelaph must be enemy or an Indian name. There was a relation between such responses and a poor performance later in the Test Phase. Nevertheless, there was a small group of children who managed to get the meaning of Kelaph right even after an initial wrong guess. There were response such as saying after Section 1 that Kelaph meant "people," but then already after Section 2 saying that it meant "a plant, like cactus, something living." These children did well in the Test Phase.

The 8-year-olds performed better than the 6-year-olds in proper vocabulary definitions. These children tended to repeat the words after the experimenter. They often used qualifying phrases like "sort of" and "kind of." Their definitions of words were longer and more to the point than were the definitions given by children in the two younger groups. However, their definitions were descriptive rather than real categorical definitions. There were responses for Kelaph showing that the children had picked information about it in the story but that the information then became coloured with the main theme and with the main events in the story. There were children, for example, who connected Kelaph with the enemy or with a person, by saying, for example, after having listened to Section 3: "An Indian dressed in deer or bear skin." A few children said, as the young children also had, that: "Kelaph is an animal." There were, however, many more children who remembered hearing the word "Kelaph" in the story even if they could not state what they had heard. A few children got the word "Kelaph" right almost from the beginning and as some younger children who also had got the word right early, these children did well in the Test Phase. An example of this type are the responses of Roger (age 8.9), who said that Kelaph was: "Some sort of plant 'cause the leaves had been used for bandage." After he had heard Section 3, he said: "Could it be a tree because skin would be bark and it has got leaves?" And John (age 8.1) said after he had heard Section 1, that he did not know the pronunciation of "Kelaph." But after Section 2, he said: "I have never heard of a Kelaph before, but it must be some sort of a plant that they crushed for bandages." After Section 3, he recalled that the Pimas had used the tough juices of Kelaph to engrave shells and said: "It's a desert plant tree." When he was asked to put together his definitions from all the sections, he said: "It must be some kind of a flower that they grew."

The 10-year-olds gave definitions of words that were more accurate than were the definitions of the three younger age groups. They gave a word other than the word they had been asked to define, instead of giving descriptions such as younger children had done. It was only in this age group that children could give definitions as requested for words such as "Clan." There were more recalls of Kelaph from the story. The children also picked contextual information on the word from the story. However, there were cases in which the children could not properly piece together the information that they had gleaned. The most common definition of Kelaph was that it meant "men" or "enemies" or "warmen" or "men who danced and ladies who danced." There were even children who said nothing about Kelaph. There were children who gave the reverse meanings of the words such as saying "enemy" was "friend." There were children who got some information on Kelaph right and had picked some contextual clues--children such as Ina (age 10.3) who said "They used Kelaphs like berries to dye things" (Section 1); "It could be Keila that they used"(Section 2), and "The hard skins, the rough Kelaph skins"(Section 3). When she was asked to connect her definitions, she brought in background information that led her astray and said that Kelaph must be: "The blood of some buffalo, well, I know they used blood for medicine and berries to dye things."

The children tended to fit the information that they had grasped into a whole, but incorrectly. For example, Robert (age 9.7) replied that the man reading the story had said: "They picked up the animals." Thus, his inference shows that he may have mixed information from two phrases: "Hunting animals" and "Collecting Kelaphs." Since his attention may have been drawn to the unfamiliar word, "Kelaph," the combined effort: "They picked up the animals" may have happened instantaneously.

Joos (1967, 1972) has spoken of heuristics. It is like the text that the children heard was "swallowed" or understood at an intuitive, heuristic level, which made it difficult for them to give direct definitions of the new term. Some of their answers to the words were quite imaginative, such as: "Spirits are like electric wool." They used their imaginations in order to combine what they had heard and to create, in conjunction with their previous knowledge, an answer that was meaningful to them, an answer that made sense in the situation.

The Control Condition.

The Control Condition reflected the children's abilities to comprehend text. Storytelling is a familiar activity for children. However, in this condition, the children did not need to pay attention to the individual words in the text in order to gain some understanding of the story. Therefore, pre-emption may have been a problem for the children. While they knew what was happening in the story, they did not have to make inferences about the new word. They could make sense of the situation without inferring what Kelaph meant. If the children in this condition tried to make sense of the new term, what they may have found was that all the objects and actions that occurred already could be given familiar names and that Kelaph was redundant. This would pose a problem. Thus, the nature of the story may not have required specific identification of a referent so that the problem of pre-emption did not arise. This was in contrast with a situation like the one the Indirect children had. They were asked: "Can you now hand me the X." The Controls may not at all have objectified their thinking so as to consider word-object pairing.

The types of responses that the Controls gave reflected the information that they had picked and regarded as being salient. A passage of time was allowed between the child's initial encounter with the new word and subsequent encounters. This lapse resulted in a considerable modification of the information retained, perhaps with the more idiosyncratic responses being eliminated. However, there were interferences in the children's processing. Even if they were not asked in the intervals between the sections, about the meanings of words and about Kelaph, they were asked questions about the theme of the story. These questions were, to some extent, interventions in their processing of linguistic information from the story. It needs to be established by the use of other future designs what would happen if the Controls had no such intervening questions about theme but instead listened to the story in one piece and then responded to questions.

The children were sometimes not too sure about Kelaph when they had been presented with the test materials in Test 1. This lends support to Joos's ideas that when speaking of the intension of a new word, or its connotation, linguistic processing is vague. Even if the children had already mapped Kelaph as plant in the Encoding Phase, they said that they thought Kelaph looked somewhat different than the Kelaph symbol and the Kelaph clay model. Therefore, spontaneous reconstructions were seen in Test 1 and Test 2 when the children asked for second trials and recorrected themselves by piecing together information from the story and from the test materials.

The 4-year-olds could not deal with many of the questions about the story's theme. Therefore, the questions were simplified and the children, being requested to recall the Thunderbird, the Indian's festival and dancing, were asked questions such as: "Did the Pimas live in a forest, in a desert, or in a fertile land?" or "Was it a real monster or a dust monster?" The third section of the story was the hardest for children of all the age groups to recall. It was common for the young children to think that the Monster was just a man dressed up as a monster. There were not so many recalls reported on events in the story. Few children mentioned "Kelaph" spontaneously and those who did so were not questioned about it further. These young children were quite talkative. They were also attentive to the questions asked even if they were not able to answer properly. There was a relationship between good recalls from the story and performance in the Test Phase. It was quite common for the children to slip back into familiarity. They had often grasped some of the events and objects that were talked about in the story but could not express these except with their familiar words, such as the word "horsie" for "deer." The children tended to connect differing information from various sentences within a given section into one piece of information. For example, when the experimenter asked if the Pimas grew anything in the desert, the child answered: "Just one horsie grow" (Eve, age 4.1). Another example of a similar strategy was when Lorna (age 4.2), who had picked up something about a plant in the story, was asked if the Indians hunted animals, and answered: "Swarfs, little creatures that grow in the ground." In the Test Phase when she was asked: "What is a Kelaph?", she answered: "A weaver." When she was asked again, she said: "It's a Kela."

The 6-year-olds had greater recall of the story. However, they, like the 4-year-olds, needed a briefing of the questions. Few showed spontaneous recalls of Kelaph. The children were interested in the story and could answer the questions in their own style. An example is Peter (age 5.8), who said: "I think they grow the crop," when he was asked if the Pimas grew anything.

The 8-year-olds often spoke spontaneously about the story and went on and on about it. There were various recalls of Kelaph in connection with something else, such as noticing that "the Pimas used skin for clothes" (Katherine, age 8.2). Generally, the recall from the story was good and no briefing of the questions was needed, or choices such as the experimenter asking if the Pimas lived in a forest or in a desert. The children could be asked plainly: "In what sort of land did the Pimas live?" The children noticed aspects of the story such as the other bird, Bareg, and the magpies that accompanied the Thunderbird and said, for example: "It flew by, other birds joined it, all the birds saw it and joined in" (Shivan, age 8.5). The children now spoke of the monster, Gila, in Section 2, as a dust monster, not as a real one. They brought in their knowledge, as did Lesley (age 8.9), who said that: "The Pimas lived on buffalo meat and used to eat the insides of them and use the skins for jackets and clothes." There were children who recalled that the Pimas wore clothes that were decorated with engraved shells. However, few of them in the Encoding Phase had recollections that bore directly on Kelaph. Often this did not happen until the end of the Test Phase. Then there were children who could recall information from the story about Kelaph.

The 10-year-olds gave good and detailed recalls of the main events in the story. There were children who had quite good recall of all the main events and also of other information that was not as outstanding. These children gave accurate descriptions. The following is an example of Control testing with Neil (age 10.3):

Section 1.

E: Can you tell me in what sort of land the Pima Indians lived?

S: It was all desert, it was sandy.

E: What food did they have there?

S: Wild deer and all the animals they could hunt.

E: Did they grow something in the desert?

S: No, didn't hear that.

E: Were they an old or a young clan?

S: Old, they went back, I think 900 years, they were as natural as the mountains in the land.

Section 2.

E: Did you hear about the Thunderbird?

S: Well, it was supposed to carry a lake, the lightning flashed from his beak and there was rolling of thunder.

E: What did the Thunderbird do for the Pimas?

S: It was supposed to have protected their clan, and it goes back in the years.

E: Did they have some enemies in the desert?

S: Yes, they thought there was a big some sort of sand monster that arose every noon which they feared more than anything. And they only fought when they had to defend themselves.

Section 3.

E: What happened at the Thunderbird festivals?

S: Well, they all came to honour the Thunderbird, a sort of. All the ladies came and they all wore copper bells that jingled when they danced.

E: Was there something strange about the high priest's lodge?

S: It was said to be enveloped in white winds and white mist, or something, that's what was special about it; but then it was just ordinary like the other houses.

E: What about the spirits?

S: I don't know.

Test 1.

"Okay", he says when asked to group the signs, takes good care here and looks through his groups.

Gives Rocks correctly.

Gives Kelaphs correctly.

When asked about the Baregs he says "Pardon?" and looks at E.

Gives Monsters correctly.

Test 2.

When asked to match, he says: "Oh, yeah, right."

Points to the Rocks correctly.

Points to the Kelaphs correctly

Points to the Baregs correctly.

Points to the Monsters correctly.

Test 3.

These are the Kelaphs.

These are the Rocks.

These are the Monsters.

These are the Baregs.

Test 4.

Points quickly to the Kelaph and laughs.

A deer.

A butterfly.

A table upside down (for the spider).

Test 5.

E: Can you now draw me a Kelaph?

S: "The sign, or the actual?" he asks.

E: Just whatever you prefer.

S: Draws the sign.

Test 6.

E: What do you think a Kelaph is?

S: A flower, or a kind of herb.

E: Why do you think so?

S: Because it said in the story that they crushed them and that's what you do with herbs to heal and also because that's the shape, he says, and points to the Kelaph symbol in the box.

Posttests.

Test 1.

All correct.

Test 2.

All correct.

Test 3.

Can name all. Says Kerlof.

Test 4.

A plant.

Test 5.

A kerlof, Astam, dandelion, thistle, daffodil, buttercup, heather, nettles.

Many children noticed the skin of the desert deer used for clothing in Section 1 and reported on that spontaneously. There were children who noticed something about a cactus as early as Section 1; for example, Regina (age 10.6) spoke of: " A cactus that the Pimas grew and ate the inside of it." And there were children who spontaneously recalled pieces of contextual information and reported on it without being asked. Anthoni (age 9.10) for instance, said: "The thick skin of the Kelaph" and "Carve stuff on." Thus, contextual information and memory for instances grew stronger with age and so did the ability the children had to make the right connections of these clues.

Discussion.

The following is a discussion of the main trends in the developmental data of Experiment 2. Children's understanding of an utterance in relation to a wider linguistic context is influenced both by their current linguistic knowledge and by inferences and hypotheses that they make based upon evaluation of the present context. When the development of the unfamiliar word, Kelaph, was traced in the responses of the children, hypotheses that they were making when questioned in the Encoding Phase on the meaning of the new term often resulted in faulty lexical entries or completely wrong ones. However, older children were better able to recover from such erroneous entries. Individual variation also played a crucial role in performance within each condition and age group. There was a noted willingness in the children to participate in the whole procedure, together with their habit of sticking to the required pragmatics of the experimental situation; they did not play around or deviate from the instructions that they were given and appeared to try their best.

The natural heuristics that Joos (1972) has spoken of as underlying the incidental deciphering of a word meaning from text, clearly were suppressed by early questioning in the experiment and pressure for intentional learning; thus, the experimental data gives valuable insights into the growth of word meaning in the maturing child when deciphering words from text.

Age and Condition.

The children employed much self-regulatory activity through the use of various resources; this technique counterbalanced some of the ambiguity of the experimental situation for the experimental children. Recovery from error was possible, but total recovery was difficult. The experimental children were able to learn from the stimuli materials without relating holistic information from the story to the meaning of the new word. This probably accounted for many of their correct responses in the tests and why they seemed in some cases to do better at first than the Control children did. The experimental children of all conditions and of all ages were certainly influenced in their responses by the manipulations of intentional learning they had been subjected to, even though many scored well on the tests. This influence is reflected, however, in their drawings and definitions of Kelaph; they could draw the Kelaph symbol, and could even say that it is a flower, but they did not relate that to a connotation of the new term as often as the Control children, who had been subjected to an incidental learning procedure. Even when they showed a drawing of a plant, they were not always able to state what a Kelaph was. The Controls in all age groups produced many good drawings of plants or flowers rather than drawing the test symbols as the majority of the children in the experimental conditions did. The Controls were more likely to interpret a Kelaph correctly.

Age proved to be an important variable in Experiment 2. The effect of Age was reflected in all conditions in the Encoding Phase, with older children exhibiting in all conditions in the Test Phase better recall of the story, better word definitions, better recoveries from error, and more correct responding. However, the results indicated that Age was not as strong a variable as it was in Experiment 1. Mechanisms for the deciphering of words are developed early and changes in the skills of older children were based on factors such as older children having greater knowledge in a better-structured knowledge domain for plants, better auditory and memory skills, and a better-developed metalinguistic awareness. Providing fewer sentential contexts for the new term in Experiment 2 than in Experiment 1, gave greater control over the contribution of the linguistic encounter that the children had with the new term, "Kelaph."

Accompanied by very good linguistic abilities, as reflected by good recall and vocabularies in both the Encoding Phase and in the Test Phase, many children in all age groups seemed to overcome the ambiguity of the experimental setting, and the difficulty of the experiment as a whole, whatever their experimental condition, and gave correct answers in most, if not all, tests. The younger children were generally more imaginative and spontaneous, but still direct in their responses. The natural heuristics in the responses of the younger children may have been counterbalanced by the older children's growing skills of memory and rationality and greater knowledge about the world; these factors again often seemed to work against the natural heuristics of the older children. When they started to think consciously about the meaning of the new term, these factors, which they had not yet mastered, suppressed the natural heuristics with resulting erroneous entries.

Generally, if blessed with a good linguistic ability, even the young children were able to decipher the new term properly. These natural heuristics didn't seem to be easily suppressed in the older children with good recall, good vocabulary, or correct mappings of the test stimuli.

For many children in the Metalinguistic Condition, too much pressure for definitions resulted in faulty entries of the new term and a lack of concept attainment; whereas a delayed response time, as in the case of the Controls, resulted in clearer connotations and conceptual knowledge.

Revelations of the Tests.

In Experiment 2 there were 32 children of the total sample of 192 children who had all the 6 tests of the Test Phase correct, and 63 children had all the remaining 5 tests correct when the Test of Production (Test 3) had been omitted. Thus, there were fewer correct responses from children in this experiment than in Experiment 1. The children now heard the new word in fewer sentential contexts and had two sets of stimuli materials to adapt to instead of one set in the former experiment. These differences in the experimental design--a lack of exposure and practise--may account for the poorer performance.

Two-Way Anova showed main effects of Age, $\underline{F}(3.180) = 4.39$, $\underline{p} = .005$ and of Condition, $\underline{F}(2.180) = 3.25$, $\underline{p} < .05$ for the combined score Full Meaning from all subtests in the Test Phase. Age group 10.6 performed best overall and subjects in the Control condition gave better performance than did subjects in any other age group.

A strong **correlation exists** *among some of the tests:* the strongest correlation among Test 5 (Depiction) and Test 6 (Interpretation) (.67**) and among Test 4 (Discrimination) and Test 5 (Depiction) (.55**). These tests clearly tap the interrelated functions of various psychological processes necessary for proper performance. Children who score highly overall score well in all these tests; on one hand, the tests of Symbol Comprehension and Object Comprehension may be highly related by their nature: they cover similar domains; on the other hand, little contamination may exist between some of the tests such as the tests of Discrimination and Depiction or between tests of Depiction and Interpretation as they cover different domains, the correlation may indicate high scores for other tests and the requirement of a similar ability in discerning elements however in two different domains--the one of linguistic competence, the other of graphic competence--similar to having a good logical reasoning ability, that helps, for example, in tests of some mathematical ability (but not necessarily in other mathematical fields), and in tests of linguistic ability.

In all the conditions and with the youngest children of 4, errors were repeated from the beginning; there were children who were wrong on all tests. Other children were correct on two out of four referents and "Bareg" for "Kelaph" was a common mistake. There were children who had the first tests correct and the later tests incorrect or vice versa, mismatching the Bareg for the Kelaph in three out of six tests. Quite a few drew the Kelaph symbol and among the Controls there were more productions of pictures looking like flowers than there were pictures of symbols for Controls in all age groups. Many of the young children referred to appearances when they interpreted, for example, Kelaph by basing their definitions on the look of the symbol saying: "Cause them bits, them lines." A few could relate to the story: "It looks like flowers and the Indians use them for flower," but quite many did not recall having heard the word. It was quite clear in the experiment that the whole procedure was too difficult for the youngest children and the story was too complex for them.

A similar pattern was found in the next age group of 6, but here there were more recoveries from error. Even if the mismatch of Baregs for Kelaphs was common in all ages and conditions, there were Control subjects that mismatched the Gila and the Bareg; but many older Controls recovered from that error later in the tests, or even as early as Test 2. The children who stuck to their errors had often made an error as early as the Encoding Phase, such as the child who constantly thought of Kelaph as an animal. When asked to give reasons for that, he responded: "It's just an animal like the deer that they killed for its skins." There were other erroneous interpretations of Kelaph near the end of the experiment such as: "Like a hut"; "like a letter," "like a signal," "like fruit," "like pot with bulb in." Then there were children who did better and could draw the symbol, but could only say: "It's a flower or plant," because of appearances, or a few who made use of information in both the story and in the test materials and said: "The Kelaph is a flower, I think."

Still there were children in Test 5 (Depiction) who had done all their tests correct but could not define Kelaph in Test 6 (Interpretation) and this happened most often for children in the young Indirect groups. Those who were correct in all tests or almost all tests were more likely to make recollections from the story such as: "It was used for bandage," or to recall Kelaph in connection with the desert deer and skins used for clothing, or to say something like: "They took the hard skins off them."

There was an increase in correct responses to all tests in the children of age group 8 and a higher rise in the children of age group 10. But still there were children in both these older age groups who had three referents out of four wrong every time. There were children who had partial entries for Kelaph; usually they had picked up information on it from the story, such as "Kelaph is used to mend or burn something"; "They put it into their shells and use it to decorate things"; or "It was paint or powder." But then there were subjects who recalled valuable contextual information from the story and could connect it properly and got Kelaph right throughout: "It was in the desert; it would have spiky leaves and the flowers, red or blue would give out the dye; there could have been juice in the stem, ancestors had taught them how to cure wounds..."

In many studies of the acquisition of the meaning of new words, the range of possible properties that were referred to was highly constrained. When a number of properties are available for reference, the question is whether lexical contrast would still be informative to children for the meaning of a new term. The use of the term "strategy" indicates that there are certain regularities in the children's decision making. Provided that reference is established, children will use the first referent as the basis for subsequent attempts at mapping the meaning of the new word. Reference is not a property of words, per se, but of words containing expressions in concrete utterances. In grasping the sense of a word, one is not certainly assured of a reference.

There were common responses from subjects in all conditions and age groups in some of the tests--for example, in Test 3, Production, various pronunciations of Kelaph: Kelagh, Kerlaph, Kerl, Kalaph, Kelogh, Keila, Kela, Kerlegh, and Kivalh. Kela was the most popular pronunciation apart from the proper one, Kelaph. For the Bareg there were pronunciations such as Bar, Barog, Barnag, Barleg, and Gareg. The ability to produce the word "Kelaph" grew with age and properly pronouncing the term was better in the experimental conditions, probably because those children had heard the word more often. It was common for the children to give all items familiar names, such as: "This is the flower" (or "daffodil" as many children said) for Kelaph; and "This is the duck," or "This is the crocodile" for Bareg. There were children who could say that Kelaph was a flower but when asked for its specific name said: "I just call it a yellow flower." Many said "Swan" for Bareg. However, there were always some who could not produce Kelaph and said that they didn't know any name for it.

In cases of lexical capture of the new term by another formerly existing term, there were examples such as "plant," "flower," "tree," "cactus," "a flowering cactus," "buttercup," "daisy" (both younger and older children), or "tulip," "lily," "waterlily" (mostly older children), or even "plantmonster" and "snailrose." "Loveheart" (which may have been directly related to the look of the Kelaph symbol) said one who had gone off the track. Bareg was much more often captured lexically than was the Kelaph by other bird names such as "hen," "goose," "duck," "swan" (said by younger children), "magpie," and "osprey" (said by older children, mostly). And one young child named it "a bad duck named Popo." It was quite common in all ages and conditions that the Bareg was named for the Kelaph and vice verse, but not necessarily because the child had mismatched these two in other tests, even if that happened also. The Control children who could produce Kelaph did not all say Bareg for the bird and even gave no name for Bareg. Few of the younger ones tried to name the monster (Gila).

The same developmental trend in difference between comprehension and production was found in the experiment as in Experiment 1: producing the new term was harder for the children than for them to show signs of comprehension.

In Test 4, Discrimination, the children had not seen the three symbols of the deer, butterfly, and spider; only the Kelaph symbol on the layout was familiar from the earlier tests. This may be a reason for high scores in Test 4; i.e. the children chose the familiar symbol, not necessarily because they had mapped the underlying concept properly, but because they had gained familiarity with that symbol before. The children saw the layout with four symbols and were asked to show or point to the Kelaph symbol; therefore they might have linked the word they had heard earlier in the tests with the familiar symbol. Both younger and older children were presented with the same number of symbols, one of each on the layout. Many young children did as well as they had done already in the Encoding Phase and in Test 1. One reason why children in the two youngest age groups did well in Test 4 is possibly related to the fact that they had been presented, in Test 1, with one or two symbols of each group instead of four symbols in each group, as was the case with the older children. Fewer symbols might have made them more confident.

Pilot Testing had shown that for young children to work with four symbols of each group and to sort them was confusing; therefore, it was decided to present them with only one or two symbols of each group. In order to estimate whether the younger children's responses in Test 4 were biased because they had fewer symbols to work with earlier, I estimated their total performance. As many of the younger children did well in the other tests, which were not based on symbols, I conclude that their results were not biased because of fewer symbols. Besides, among the 8- and 10-year-olds there were not as many confusions when they sorted the symbols. Children of 8 and 10 years have learned proper skills for this simple sorting.

Holistic skills based on resemblance mechanisms are established early. Children are at the peak of their language acquisition from ages 1 to 4. Resemblance mechanisms are needed for the processing of symbolic representations as the ones in the figurative drawings of the Pima symbols. I would argue that resemblance mechanisms account for the instantaneous mappings observed in the children's first encounter with the new term and symbol. This holistic mode of resemblance was suppressed when the children tried to figure out logically or think consciously about the meaning of the symbols. Then remarks of criterial features of, for example, the Kelaph symbol were given such as: "This one looks like an arrowhead" or "This one looks like fire." In order for the child to make proper use of criterial features, s/he must grow in age and skill for proper decontextualisation to take place. However, as Donaldson has argued (1978, 1992), children make use of a variety of coding schemes in the mapping process. They use a blend of acquisition strategies or modes of knowledge. And above all, they are adaptive. It can be stated on basis of the results in Test 4 that it was difficult to pin down the mapping that each child used to one mode. Nevertheless, for the children to use a logical, analytical mode which they had not mastered interfered with their correct mappings.

The experiment demonstrated that the use of drawings in Test 5 were valuable tools in a language development study. By the same token, Test 5 gave valuable insights into the development of drawing in the growing child.

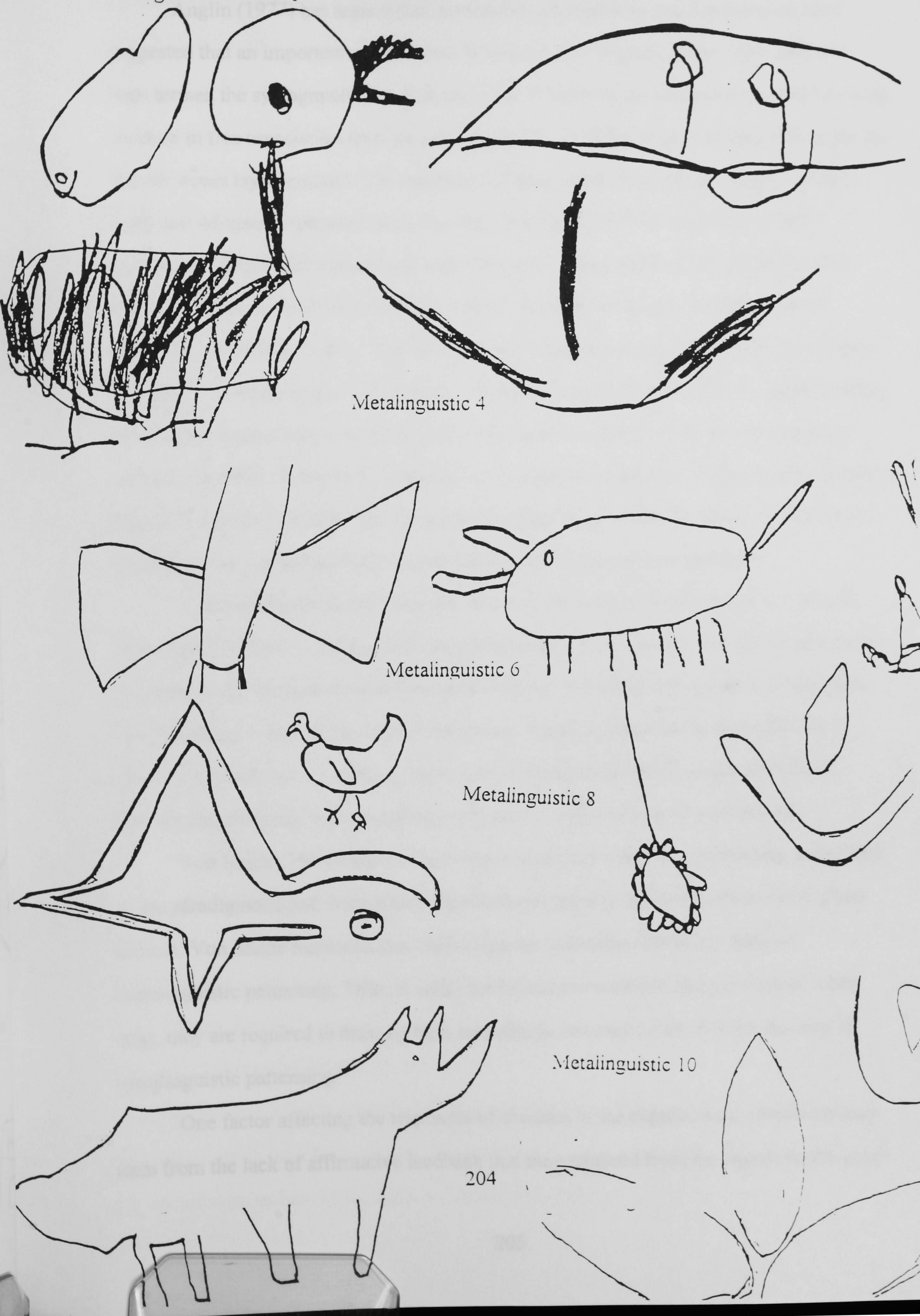
The younger children often produced more abstract-looking pictures than did the older children (Bruner, 1966; Thomas & Silk, 1990). I am not claiming that they were abstract in their thinking, but according to Krampen (1991), the young children are at the stage of caricatures, the symbolic stage in their drawing development. Even the youngest age group of 4-year-olds had already started learning to write in school. Berk (1986) has stressed the interrelation of the developments of language and writing. As stated in Krampen (1991), Lurcat pointed out in the late fifties that the main aspects of grapheme development in children in her study of a large collection of writing and drawing in young children. The symbols in the experiment are somewhat graphemic, and the children--even young children--drew them with ease. Krampen (1991) holds that:

> It is from the environment that the internal models on which the drawings are based are derived. Because these internal models are iconic codings of the environment, children's drawings are equally based on iconic codings of that environment, albeit one step removed. The function circle that leads to the production of children's drawings starts with the perceptual exploration of the environment and then leads, via the interpretant - that is, via the imitation of this exploratory activity in the internal model - to an internal disposition to make traces on paper controlled by that model (p. 44-45).

On the following pages examples of drawings from the children in all age groups and conditions are presented (Fig. 3.7., 3.8., p. 203-204).

Figure 3.7. Examples of Drawings (Controls and Indirects ages 4, 6, 8 and 10)

Figure 3.8. Examples of Drawings (Metalinguistics ages 4, 6, 8 and 10)



Restructuring.

Anglin (1977) has argued that developmental studies of word association have suggested that an important event occurs between 5 and 10 years of age. This shift has been termed the syntagmatic-paradigmatic shift. It refers to the fact that responses of young children in free association tests are predominantly of a different part of speech than are the stimuli words (syntagmatic). The responses of older children are predominantly of the same part-of-speech (paradigmatic). As cited in Anglin (1977) Woodworth (1938) presented examples for syntagmatic responses from young children. For example, they associate the word "eat" with the word "table"; whereas adults are more likely to say "chair" in response to "table." The most common response to the word "dark" for children is "night," whereas for adults it is "light." This shift has much to do with the understanding of relations among words so that for older children and adults, words are not unrelated entities, but rather cohere in a system, or in a lexical network that is determined by features shared by groups of words. This network takes time to grow but the extent to which it is a quantitative or a qualitative change that takes place is still an open question.

For both the 8-year-olds and the 10-year-olds in Experiments 1 and 2, a drop in performance is seen as compared to the performance of the younger two age groups and as compared to the performance of the oldest children. It is likely that a shift is taking place. This syntagmatic-paradigmatic shift takes time. Children between the ages of 8 and 10, who are in the process of shifting, have not yet mastered the newly acquired skills of lexical reorganisation, and a resulting confusion is reflected in their performance.

Von Slagle (1974) refers to Joos when speaking of linguistic patterning at the level of the paradigmatic and syntagmatic distributional patterns of the elements of any given lexicon. Von Slagle maintains that such linguistic patterning ultimately rests on extralinguistic patterning. Thus, in order for children to establish the reference of a new term, they are required to draw on their knowledge, not only of the lexicon, but also of extralinguistic patterning.

One factor affecting the responses of children in the experimental conditions may stem from the lack of affirmative feedback that they received from the experimenter in the

Encoding Phase; they might have thought that they must be constantly wrong in their responses, since they did not get affirmative feedback from them, and that they must try something else. Also, earlier studies have shown that it is difficult for young children to define words directly (Dockrell, 1981; Campbell & Dockrell, 1986).

It should be emphasised that the Control children had only heard the target word three times before being tested on it, whereas the Metalinguistic children had already, at the start of the Test Phase heard the word three times in the story and been questioned on it. Furthermore, the Indirect children had already gained familiarity with the test sample of symbols in the Encoding. And it should be noted that the scores of Controls in all age groups for the first test in the Test Phase were usually better than a combined score for the performance of the experimental children when their three interval scores of the Encoding Phase have been added.

Notably, the children were often stressing their point, perhaps the same one through all sections and tests, and often spoke aloud to themselves or murmured, or moved their lips silently, so as to provide an understandable, or, more importantly, a manageable framework for themselves. They seemed to require a sense of familiarity, a self-motivated task orientation. I feel this characteristic is what Vygotsky (1962) touched upon as he spoke of the relationship between language and thought and of the importance of private speech. Private speech being speech to oneself having the function of relating the child to his/her social world and his or her inner world of self. The behaviour of the children indicated that they were using private speech to monitor their thinking and acting and was a factor in their lexical reorganisation of the meaning of the new term.

The children were hearing many unfamiliar words in the complex text such as Pimas, Gila, Bareg, and Kelaph at the same time that they were processing information on the story's theme, structure, main characters, and events.

When the child encounters a new term that is not captured lexically, s/he can map it directly if the intended denotatum in the experimental situation is picked up. Children learn synonyms at some stage in their vocabulary growth. Pre-emption or lexical capture may place added strain on the mapping process but it does not preclude the acquisition of the new lexical term as having the same or similar denotation to a previously known term

(Gathercole, 1987, 1989). It still needs to be established at what age and for what word classes lexical capture is important. Pre-emption occurred more often with young children than with older children in the experiment. Dockrell (1981) has argued that children's solutions, when pre-emption and lexical contrast conflict, may depend on a number of factors, including their ability to accept synonyms; the relative importance placed on linguistic information; the degree of ambiguity within the frame of reference; and the salience of the attributes--and other similar variables

If children are learning many new names such as "Kelaph," "Bareg," and "Gila," it makes sense to assume that once they have learnt a particular name and natural kind pairing that this natural kind such as Kelaph will not be referred to by another name. The problems children encounter with class inclusion and the understanding of subordinate and superordinates categories may well reflect this difficulty. A basic linguistic competence may be necessary before children realise that there is no incongruity in referring to the same plant, for example, by two distinct names. The fact that these types of responses are only given for nouns suggests that a clear indication of the intended referent exacerbates the problem. The tasks in the experiment may not be testing the children's competence with respect to how they learn the meanings of new terms. Rather, the tasks may have assessed the children's ability to learning something new about plants for which they felt that they already had a name, such as "daffodil." Dockrell (1981) has argued that there are two methodological implications of this. On the one hand, if one is looking at children's ability to develop a referential relationship, one should confine one's presentation to a single example of the unknown item. If, on the other hand, one wishes to look at children's ability to co-ordinate a number of different pieces of information, the experiment is clearly adequate. However, there was a lack of co-ordination on the children's part, which suggests that the study was in fact examining tasks that investigate general knowledge acquisition rather than semantic acquisition. Still, "full meaning" for several children emerged and grew with age, no matter which condition, and this performance is reminiscent of semantic acquisition in natural circumstance, which entails the co-ordination of information gained over a number of exposures. There was a strong relationship between performances in the Test Phase and the Posttesting. Children who already mapped the new word properly in

Test Phase, kept doing so in the Posttesting; whereas few of the children who kept giving erroneous responses in the Test Phase recovered from their errors in the Posttesting, but stuck to the same error pattern or fluctuated between various error patterns.

Merriman et. al. have maintained (1991) that children may use encapsulated procedural knowledge that is not accessible to conscious reflection when they solve nonverbal problems. Thus, children are not able to tap into this procedural knowledge in developing the corresponding word meanings. For concepts to become word meanings, Merriman has argued, the concepts may have to be reinvented, or at least rediscovered. However, linguistic experiences may influence the initial acquisition of the nonverbal concept even when acquisition of some word meaning is contingent on possession of some non-verbal concept. The children in the experiment may have mapped the new term, Kelaph, onto their pre-existing categories of plants. However, I cannot see from their responses how the precise manner in which they represented these categories was established; whether it was based on holistic encodings or on the working out of the criterial features (Brooks, 1978; Kemler-Nelson, 1984; Carey, 1985).

Conclusions.

In the mapping for each child, one must discriminate between the development of the meaning of the word "Kelaph," or "plant," and the development of the concept of a Kelaph, or a plant. The meaning of the word "Kelaph" differed among the age groups, whereas the underlying concept seemed to rely upon the acquisition and reorganisation of the children's knowledge of plants. This growth of knowledge by age is well established in the production lists for plant terms in the Posttesting. It is suggested that the children in all the age groups based their knowledge of plants on observation and experiment that has adaptive and heuristic value for them. They may first reason from their own basic experiences of plants to the specific plants in question. Children with well-structured plant vocabularies should map the new plant term, "Kelaph," instantaneously. Memory plays a part--a crucial step in the acquisition of deductive competence involves the ability to search for counter examples--this ability is constrained by the processing capacity of working memory which develops with age (cf. Johnson-Laird, 1990 as cited in Light & Butterworth, 1992, p. 153).

"Daffodil" is, for younger children, the prototypical plant with the properties or features that are, for the children, perceptually salient aspects of the new plant. Carey (1985) maintains that "Four- and 6-year-old children rely on computations of similarity where 10-year-olds and adults rely on deductive inferences from category membership" (p. 192). It can be concluded that the knowledge that the children bring with them to the experiment about different properties of plants plays a strong role in their mapping process and frees them from the embeddedness of their thinking. Decontextualisation in the process of mapping is thought to arise through the construction of mental models that enables generalisation across various contexts. The child reasons by analogy with aspects of the situation where s/he first encountered the problem (Johnson-Laird, 1977; Light & Butterworth, 1992).

In Experiment 2, the Metalinguistic children fared worst. Indirects showed confusion and Controls did sometimes rather well. There were fewer correct mappings for the new term noted than there had been in Experiment 1. Age was not as strong a factor in

Experiment 2, either. Working with fewer sentential contexts for the new term and incorporating a control word, Bareg, provided better control of the contribution of the linguistic information that the children heard. However, it is difficult to tease out the benefits of these two factors.

The Experiment 2 sample was similar in terms of background and living standard to the sample used in Experiment 1. Half of the sample were children who had already participated in Experiment 1. The children in Experiment 1 ranged in age from 5 to 12, whereas children in Experiment 2 were younger--4-to-10-years-old. These age differences must account for differences in the results from the two experiments.

It still needs to be established if there are differences, per se, in the two natural kind terms that were employed in Experiment 1 and 2. The nature of the mineral term, "Mikas" and the nature of the plant term, "Kelaph," can account for differences in results from the two experiments.

It can be concluded from the present experiment that: a) children's knowledge of plants is a strong factor affecting mapping; b) children adhered to what has been called "everyday reasoning" in their deciphering of the unknown term, the base of which is procedural knowledge; and c) children must have a well-structured vocabulary for declarative understanding:

> The point is that everyday reasoning is generally based on two types of culturally specific knowledge, whose representation is evoked by the appropriate context. On this view the context and content of thought are inseparable from the reasoning process (Light & Butterworth, 1992, p. 7).

It can be concluded that the Control condition provided a base for holistic processing (incidental learning) needed for the construction of a mental model, whereas the analytic processing (intentional learning) provided by the Indirect condition and the Metalinguistic condition resulted in stimuli-bound decodings of the meaning of the new term. There were, however, children in all conditions who brought with them background knowledge and skills to overcome the ambiguities of their situation. These children had a strong sense of what James (1890) has called "Thingumbob"; they made favourable use of a resemblance mechanism in their encodings and decodings and were not easily misled by interferences.

CHAPTER 4
EXPERIMENT 3
A NOVEL ANIMAL TERM

Introduction.

Donaldson (1978) has spoken of a child's need for familiar contexts. In Experiments 1 and 2, children in the experimental conditions encountered interferences with their encodings of the new term. These interferences may have interfered with the recognisability of the contexts that each condition provided; the perceptual processing of linguistic information could thus have been blurred and could have led them astray in their guessing of the proper meaning of the new word. Joos (1972) has argued that the guess is best that maximises the redundancy of word and environment together. However, many children recovered from their errors. There were even children in these conditions who mapped the word correctly after one trial. Dealing with language as perceptual information means, in a daily natural circumstance, having to deal with various other variables at the same time. Children may be quite well equipped from an early age to deal with ambiguities in their situation when it comes to language. This adaptive skill to deal with many variables at one time was well reflected in their performance in the two first experiments. Thus, I would argue, on basis of the earlier results, that the child is quite adaptive.

In the present experiment, I wanted to see if 4- to 5-year-old children could cope with a design similar to those in the two former experiments, but with a story that I thought would appeal more to young children. An animal term, "Mimbo," was chosen as the unknown word. It is known that children learn animal names early (cf. Dockrell, 1981). The children in Experiment 3 heard the new term, Mimbo, six times in the story or as often as children in Experiment 1 had heard the new mineral term, Mikas; children in Experiment 2 heard the new plant term, Kelaph, only three times. I also decided to adopt the technique from Experiment 1 of having the reading of the story videotaped; in Experiment 2 the child heard the story read from an audio tape. On the other hand, I adopted the technique employed in Experiment 2 for the Indirects--that of using different stimulus materials in the Encoding Phase than in some of the tests in the Test Phase. This was done in order to give both Indirects and Controls an equal opportunity to work with new test materials, in the Test Phase and thus to avoid the bias of familiarity with the test materials which might result in a better performance for the Indirects.

The story theme I chose was one of nature, featuring animals, birds, flowers, pixies, and fairies. I thought that such a story would be familiar and interesting to 4-to-5-year-old children, who should have knowledge of what can be expected in such circumstances. Thus, the children's sensitivity for the communicative context and their sensitivity for the task demands were brought forth by the condition in which they participated and by the story context. Those children who had knowledge of the situational context were predicted to know what to expect in a forest--for example, that plants can become mouldy, what birds eat, and what lives in the soil. The purpose of the experiment was to see how children would map the meaning of the new term and to observe if they succeeded in drawing the new referent, the new animal, an unfamiliar worm-like creature.

Donaldson (1978, 1992) has argued that the manner in which children are questioned is important in research of this type and that if they are asked questions in terms they understand, they can demonstrate much more knowledge and skills than has often been thought. She speaks of the "embeddedness" of children's thinking and maintains that children can perform complex mental tasks when the tasks are embedded in a familiar context. Children learn words when they are accompanied by gestures, familiar faces, and favourite toys. To begin with, children's thinking is entirely dependent on such contexts: i.e. it is procedural. Donaldson maintains that children's thought, gradually and at a later age, becomes "freed" to the point where abstract, impersonal reasoning becomes possible. She has recently (1992) stressed the role of the development of children's emotions and their relation to the development of children's intellectual modes, or phases in the course of the decontextualisation of thought.

Werner (1948, 1950, 1954) has argued for conative or affective needs together with cognitive needs in language acquisition. Joos (1958) has pointed out that: "meaning is the result of subtractions principally, but also of additions by way of connotation, and that sentences mean what they do, so to say, BY DEFAULT, the competing meanings having been eliminated in one way or another" (p. 69). Correspondence meaning has to do with the correspondence a language makes between a "real noise and a real thing or the like" (between an utterance and its referents). This defines language as symbolic. Joos has argued. He has further maintained that overt acts of speech alter reality in that changes in the listener's behaviour correspond to them and that <u>this defines human speech as communication</u>.

There are several studies suggesting that there are not to be expected many differences in performance between 4-and-5-year old children. According to Reynell (1977, 1983), 1-to-4-year-old children are at the height of their sensitivity for acquiring language. There are few differences reported, according to her language developmental scales, in the language abilities of 4- and 5-year-olds. There are reported differences in terms of simple vocabulary items from daily life, but when it comes to the question of knowledge of the deeper structure and relations of language and a declarative skill in the use of these, there are very small differences in her sample between the two ages.

Carey (1985), in her work on conceptual change in children and the understanding of the concept "alive," for example, reports very few differences for 4- and 5-year-old children, younger children sometimes doing better. Furthermore, in drawing development, 4-year-old children are, according to Krampen (1991), at the symbolic stage, or the stage of caricatures, a stage at which their drawings often resemble more "abstract" looking icons than later emerge:

> Generally, children's drawings can be classified into five stages, starting with the scribbling stage at about eighteen months to two years. Gradually, designs emerge at about two to three years that cannot quite be called representational until the child is about three to four years old, when figures based on the tadpole schema emerge. These drawings become more coherent as the children become older. During the stage of intellectual realism children often make X-ray drawings. It is not until the child is about eight years old that visually realistic drawings start to appear (Thomas & Silk, 1990, p. 41).

Object of Study.

Experiment 3 was undertaken to find out if: a) young children, of 4 to 5 years, could decipher, from a narrative read to them on video, the meaning of an unfamiliar word, "Mimbo," that denoted an unknown animal, a worm-like creature that appeared in six different sentential contexts within the story; b) to determine if or how children as young as 4 and 5 would succeed in drawing the intended referent; and c) to observe how young children would cope in this type of experimental situation.

As in the two earlier experiments, it was predicted that the analytic/intentional learning procedure imposed by the Experimental condition, the Indirect condition, and the ambiguity inherent in the structure of the condition would be likely to lead to children making incomplete "fast mappings." This would be likely to happen in the Indirect condition and was predicted to result in a more incomplete lexical entry for the new term than in the Control condition. Results were predicted to vary as a function of Age. However, it was predicted that Age would not show as strong a trend as in the earlier two experiments, because a) the children in the present experiment were so close in age (4.4 to 5.6 years); b) because the older children were predicted to be just at the onset of a representational shift (Piaget, 1923; Bruner, 1964; Mandler, 1983); and c) because of their small school experience and educational training having yet had few benefits on the skills required. The spontaneity and natural heuristics of the younger children were expected to counterbalance the growing intellectual skills of older children.

It was hypothesised that, in the Indirect condition, the natural heuristics of lexical acquisition when deciphering from text would be suppressed, resulting in erroneous lexical entries for the new term. Control children, who were questioned about theme and plot, were not expected to be affected in this way. The same trends of recovery from error were predicted as in the two earlier experiments.

The initial aim of Experiment 3 was to build upon the results obtained in the two earlier experiments on the deciphering of words. I was interested in seeing if the artificial words, their acoustic image per se, "Mikas," "Kelaph," and a new one, "Mimbo," would be equally difficult for children. If they were not, then some of the earlier results could be explained by means of such differences. I also thought it very likely that in spite of the complexity of the task, the use of an unknown animal term would help to motivate the children, since they tend to learn such words early. As Dockrell (1981) puts it:

> By choosing an animal term I am presenting the children with a distinct perceptual entity. There is evidence (Nelson, 1973) that small concept domains such as animal terms are differentiated from the beginning of the acquisition period. By the age of two or three, children have fairly firm ideas of what constitutes animalness, though this need not necessarily be in accordance with adult ideas (p.138).

There were three different-sounding words employed in the experiment that all denoted the same referent. These words were randomised within three groups of equal size within each age level and each subject got only one of them in his/her story and in the Test Phase. The words were "Mikas," "Mimbo," and "Kelaph," and all denoted an unfamiliar worm-like creature.

One Control condition was employed during the Encoding Phase in which children encountered the unknown word in different linguistic contexts. The children were asked questions on the story's theme in the intervals between the three sections of the story. In one experimental condition, the Indirect condition, children were asked questions on a test sample of objects in the intervals between the story sections. The Metalinguistic Condition of Experiment 1 and 2 was not included, since both these experiments showed that metalinguistic questioning was too difficult and put too much strain on the youngest children.

Method.

Experiment 3 was designed with the aim of appealing to young children. As in the two earlier experiments, a story was read to the children. The story theme chosen was the one of a fairy tale. The sensitivity of the children for the demands of the situation and for the nature of the story context was thought to be awakened by the theme in which animals, flowers, and things living in a forest were discussed. Because of their experience with previous storytelling activities, cartoon films, and television shows on nature, picture books, and animal toys, I expected that children of this age would be able to expect certain things in a circumstance such as that of the story. The children who had a knowledge of the situational context, were expected to know what to expect in a forest--for example, that plants can become mouldy, what birds eat, and what lives in the soil.

The theme, which was thought to appeal to young children, was also chosen with their conative or affective needs in mind (cf. Werner & Kaplan, 1950, 1952), in the hope that it would give them scope to express themselves.

As in Experiment 2, I decided to use different materials in the Encoding Phase than in some of the tests in the Test Phase that took place after the children had listened to the story. This was done in order to control the bias that arose in the first experiment, in which the Indirect children had worked with the test materials in both the Encoding Phase and in the Test Phase. Thus, they had gained greater familiarity with the materials than had the Control and the Metalinguistic children. Therefore, blue plastic plates were employed in the Encoding Phase, but a different set of materials was used together with these in the Test Phase. There were four plastic plates, the shapes of which resembled a mouse; a bird; an unfamiliar berry, "Gombe;" and the unfamiliar worm-like creature, "Mimbo;" all of which were mentioned in the story. In the later Test Phase, the children were shown pictures bearing closer resemblances to the worm-like creature, the mouse, the bird and the berry. As these pictures had many colours and a variety of perceptual features and details, they may have looked even more complicated to some children than did the simple blue plates. However, I expected individual differences in preferences over these two sets of stimuli materials; some children to do better with the plates and others to do better with the pictures. This assumption was based on the children's performance in Experiment 2, in which there were individual preferences in performing with symbols and clay models.

Dockrell (1981) has postulated that children with no previous experience of an unknown lexical item will choose a previously unnamed stimulus as its referent almost immediately. In the present experiment, this was not as straightforward as she described, since a control referent, the unfamiliar berry, "Gombe," was also employed. Children in this experiment were required to deal with two new names and two concepts. The contrast provided was much more ambiguous and the children had to lean on to their linguistic knowledge of the text in order to map the new target word properly.

The children's responses were tape recorded and observational notes were taken incidentally as the study progressed. This was done in order to estimate each child's total performance and to tap general trends in responding and attitude towards the experimental situation.

The scoring procedure employed was the same as the one used in Experiment 1 and Experiment 2. (See Experiment 1, p. 47-48 and p. 64-65 for a description of the scoring procedure). The child scored 1 for a correct answer and 0 for a wrong one.

Reynell (1977) has stressed the importance of continuing to present test materials for young children even if the questions on these materials seem meaningless to them, and that to discontinue the testing too soon was to risk misscoring the child. I had learned from Experiment 1 and Experiment 2 that working with the youngest children required more time and made greater demands on the experimenter's discretion, and that, when in doubt, it was better to continue with the testing than to stop entirely and to risk an inappropriate score of "0" for a child who could have scored "1."

Subjects and Experimental Design.

Seventy-two subjects were employed in this study, ranging in age from 4.4 to 5.6 and were divided into two age groups, referred to below as the 4-and-5-year-old group. There was an equal number of boys and girls in each age group and in each condition.

At each age level the children were randomly assigned to an Experimental condition, an Indirect condition and a Control condition. Subjects were obtained from a) two Primary Schools in Central Scotland--a morning and an afternoon group from Dunblane Primary and Dunblane Nursery; b) Balquhidder Primary; and c) two play-groups -- the Psychology Department Playgroup at Stirling University and Killin Playgroup. These children did not come from similar areas as regards living standards and social environment. There are differences between the social environments of middle class standards in Dunblane and Stirling as compared to the rural farming environments of Balquhidder and Killin. Some of the same children took part in Experiment 3 as had participated in Experiment 2, i.e. young children from the morning and afternoon Nursery in Dunblane and children from Primary One in Dunblane. Some of the nursery children had already scored very high in Experiment 2. All these children knew the experimenter very well and were already familiar with this type of a situation, even though it differed somewhat from that of earlier studies. The initial sample was supposed to be 96, but was reduced to 72 because of many inconveniences such as the experimenter's absence from Scotland, difficult testing circumstances in Killin, and the complexity of the experiment. Thus, in the sample of 72 there were data included from 12 children who, due to difficulties in testing and testing circumstance, were not deemed to be accurate.

Materials and Procedure.

The overall experimental setting was the one of a story presented in four sections about a small pixie, "Nandi," and his life in a forest. (See Table 4.3., p. 222). The children were invited to learn about the pixie and his life in the forest and to examine some pictures and objects from his surroundings. The main story theme was the one of the pixie's life and his worries about being different from the other pixies; the story told about his attempts to find happiness. In the course of the story, the children heard one of three new terms: "Mimbo," "Kelaph," or "Mikas," (according to the group for the new word to which they belonged). The story was presented in four sections and the children heard the word "Mimbo" in six different sentential contexts. (See Table 4.1., p. 221 and Table 4.2., p. 221). Mimbo denoted an unfamiliar worm-like creature. The children also heard a control word, "Gombe," that denoted an unfamiliar berry, twice in the second and fourth sections. Some of the objects used in the Encoding and the Test Phase were also mentioned in the story: yellow irises, a bird, and a mouse that shared some properties with the Mimbo. All the natural kinds employed in the study shared some functions, and some semantic, perceptual, and conceptual features with Mimbo, the unfamiliar worm-like creature. They were all alive; the iris and the Gombe both grow, can be picked, can go mouldy, cannot move on their own volition, and could be edible. The Mimbo, the mouse, and the bird do not grow, but breathe and reproduce, can move on their own volition, and are edible by humans or other animals. The Mimbo and the mouse can both live under the ground, whereas the bird lives on the ground, or in trees and bushes. According to Carey (1985), the Mimbo, the mouse, and the bird, being animals, are closer to the concept of "alive" for young children than are the Gombe or the iris.

The story was presented to the children in a room close to the playgroup or the classroom. During the two weeks before the experiment started, the experimenter had visited the children daily, so as to evoke trust and familiarity. She told them that she was soon going to invite them to watch a story on video, and asked if they were willing to help her with questions about it. The story sections were purposely made rather long, in order to be comparable to the length of the story sections in Experiment 1 and Experiment 2.

Pilot Testing.

The pilot testing for the experiment was done with eight children from the Psychology Department Playgroup at Stirling University and from Balquhidder Primary. Initially, the experimental design included the use of clay for the Control children to play with in the interval sections during the Encoding Phase while they were asked questions about the theme of the story. However, pilot testing revealed that playing with the clay was too much of a distraction for the Control children and this practice was therefore not adhered to in the real testing. Instead, the children were allowed to look at a picture of Nandi in the intervals. Because pilot testing also showed that the younger Control children had difficulties in answering the questions about the theme of the story and often paused, these questions were therefore simplified.

Encoding Phase.

The method of indirect questioning was used to probe word knowledge during the Encoding phase in one experimental condition, the Indirect condition.

Table 4.1 and Table 4.2. on the following page (221) show the sentential contexts for the target word, Mimbo, (Kelaph, Mikas) and for the control word, Gombe, used in the story format.

Table 4.1.

The Six-Sentence Exposures of the Unknown Word Mimbo (Kelaph, Mikas, the Target Word) in Experiment 3.

Section 1:	"Some Mimbos have been in these mushrooms already," he cries out somewhat annoyed. Well, the Mimbos can only move slowly while I can run.
Section 2:	Then he steps on something soft and long which nearly gets squashed. "Oh, it is a Mimbo. So sorry," he says softly.
Section 3:	A lone bird sits there and digs for blue Mimbos. His favourites. As Nandi turns from the door, he sees that lone bird again but this time with a blue Mimbo in his beak.
Section 4:	Well, on the bank of the silvery stream where the Mimbos live in the damp, dark soil, there are the yellow irises, the flowers that grow by the stream.

Table 4.2.

The Two-Sentence Exposures of the Unfamiliar Word Gombe (the Control Word) in Experiment 3.

Section 2:	A new day has broken and in the cool morning breeze some gleaming Gombes dingle dangle merrily on their hedge.
Section 4:	He picks a few juicy Gombes from his hedge to eat.

Table 4.3.

Example of Text from the Story used in Experiment 3:

Section 1.

Across the magic meadow by the silvery stream, Wild Wood opens onto a chain of lofty mountains. The trees of Wild Wood are very, very tall. Up and up they tower. But down on the ground among the evergreen bushes and multicoloured flowers, the bright-eyed pixie, Nandi, makes his swift ways. Swifter than a mouse even.

Nandi is a busy fellow. In Spring and Summer, for example, he has the job of polishing gently the petal coats of Wild Wood's flowers so that they may twinkle like stars when the sun comes out to play.

Autumn has now fallen, however, and many of the flowers droop their pretty heads silently. Nandi has been given a new job. This time it is picking tasty mushrooms for the Fairy Queen's Autumn Party. Some of the mushrooms have gone mouldy. Nandi takes care not to pick those. "Some Mimbos have been in these mushrooms already," he cries out somewhat annoyed. Well, the Mimbos can only move slowly while I can run. I should be able to get to more mushrooms than they can," he then adds and brightens up at the thought.

(The whole story can be seen in Appendix C, p. C1-C3).

The Indirect Condition.

Following each of the four story sections, the children were given a test sample of four blue plastic plates, one of a blue worm-like creature, Mimbo, one of an unfamiliar-looking berry, Gombe, one of a mouse, and one of a bird. The blue plastic Mimbo was 127 mm. (w) x 135 mm. (h). The blue plastic berry was 75 mm. (h) x 105 mm. (w). The blue plastic mouse was 102 mm. (h) x 83 mm. (w). The blue plastic bird was 186 mm. (h) x 140 mm. (w) (see Photo 4.1., p. 228). After having looked at these, the children were asked to give them to the experimenter as she asked for them by name, such as: "Can you now hand me the Mimbo plate; the mouse plate." The plates were always asked for in a random order in each section.

The Control Condition.

Following story sections, the children were asked three or four questions about the theme of the section and its main events: Section 1: "Where did Nandi live?" "Was he picking something in the wood?" "For whom was Nandi working?" In Section 2: "Was there something strange with Nandi's eyes?" "Did Nandi use his own magic wand to change his eyes?" "Did his blue eye stay blue or turn brown?" In Section 3: "Did he go to see wise elf?" "Could wise elf change Nandi's blue eye?" "Did he say something about Nandi's irises?" In Section 4: "Did the fairy queen come to see Nandi in his sleep?" "Did the fairy queen say something about his irises?" "What are the irises?"

Test Phase.

The Test Phase was conducted shortly after the children had listened to the whole story and had been through the four sections. Five tests were designed to test Comprehension and Production of the new term, "Mimbo." The same rationale behind the construction of these tests is the one that was underlying the tests in Experiment 1 (see Ch. 2, p. 62-68 for description). The same scoring procedure as in Experiment 1--1 for correct answers and 0 for wrong or no answers--was employed (see Ch. 2, p. 46-47 and p. 64-65).

The child's performance was to be used as a criterion for his or her lexical entry for the novel term.

Test 1. Sign Comprehension.

The children were presented with the same test sample of plastic symbols used in the Encoding Phase and were asked to hand them over as named, such as: "Can you now hand me the Mimbo plate?" (see Photo 4.1, p. 228). The children were always asked for these objects in the same order: Mimbo, mouse, Gombe, bird. Pilot testing had shown that it was too confusing for the children and the experimenter to use randomisation of both plates and pictures for each child. Therefore the same order was used with all children in the first two tests. In Test 1 the children were required to comprehend which referent in the real world the novel term denotes.

Test 2. Object Comprehension.

The children were presented with a test sample of pictures that they had not seen before, but that were all mentioned in the story: the worm-like creature, Mimbo; the control referent, Gombe; yellow irises; the mouse; and the bird. In addition, they were shown a picture of a fly, which had not been mentioned in the story.

There was a blue Mimbo with blue and white eyes, size 127 mm. (w) x 135 mm. (h). There was a twig with three berries for Gombe in blue, red, and yellow, size 75 mm. (w) x 105 mm. (h). There was a brown mouse, size 102 mm. (h) x 83 mm. (w). There was a white, red, blue and yellow bird, size 186 mm. (h) x 140 mm. (w). There was a yellow iris with some red in it, size 186 mm. (h) x 132 mm. (w), and a black, grey and blue fly with green and blue eyes, size 75 mm. (w) x 105 mm. (h) (see Photos 4.2, 4.3, p. 229-230). This test of comprehension and denotation was similar to Test 1.

I had hoped to be able to conduct the Test Phase identically for all children and to present the five tests singly to each child. However, as the experiment proceeded, I realised that I had to follow the flow of the children's needs. The whole story and design was clearly very complex for many children. Therefore, I had to incorporate prompts and encouragements in the Encoding and Test Phase and allow scope for communication to take place between the experimenter and the child.

Pilot testing had revealed that to spend too much time on a test with which the child had difficulties or felt threatened would distract his or her attention. The children's behaviour towards the test materials in Test 1 and Test 2 often indicated, for both young Indirects and Controls, that in order to gain the co-operation of the child and to keep on with the study the materials in Test 2, pictures had to be presented first. The blue plastic plates used in the Encoding Phase and Test 1 were lying on the table at the same time. All tests in the Test Phase were arranged in the same order for all children, except that there was the above-described flexibility in administrating the first two tests. Therefore, these first two tests should be regarded as pretests to the actual testing. Besides, this testing was not always consistent. The three later tests were administered the same for children of both conditions and both age groups. Thus, they provide less biased criteria of the children's understanding of the new term. Since the test sample of the blue plastic plates that was presented to the Indirects in the Encoding Phase was also presented in the first test of the Test Phase, half of the children in the total sample of 72 children, or 36 of them, were already familiar with these when it came to the Test Phase.

Test 3. Production.

The children were shown a layout of pictures of the same objects as in Test 2, together with a picture of the pixie, the elf, and the fairy queen mentioned in the story. The children were asked about each item by the experimenter: "Can you tell me the name of this one?" or I simply asked: "This is a ," "this is a ," leaving a silence for the children to fill with the proper word, as I showed each item. The pictures on the layout were the following: A Mimbo, a rainbow, a sunshine, a hen, a tree, a fly, an elf, a mouse, a pixie, a fairy queen, three Gombes, a yellow iris, and two mushrooms (see Photo 4.4, p. 231). This test gives scope to tap the ability of the children to produce the new term, to recall its name, and to compare their performance with their recognition in Tests 1 and 2.

Test 4. Depiction.

The children were asked to draw a Mimbo. The experimenter asked: "Can you now draw me a picture of a Mimbo?" Thus, the children were required to draw from memory and were only given the plates or the pictures to copy if they spontaneously asked for them. The test gives scope for children's procedural understanding of the new concept to manifest, and taps a different declarative, or expressive skill than the following test of Category.

Test 5. Category.

The children were asked what a Mimbo was, what they had drawn, and why they thought a Mimbo was that which they said. They had their drawing in front of them when they were asked: "Can you now tell me what a Mimbo is?" They were given a choice of sentences if they paused and could not answer directly and asked: "Do you think a Mimbo is an animal, a flower, a bird, or a stone?" Finally, if they could not answer directly or make use of the choices, they were asked what it looked like. And if they could not answer that, they were given the test sample of pictures that had been presented in Test 2 and asked to show the Mimbo, and then asked what it looked like.

This test called for a declarative understanding of the sense of the new term. A brief questioning about the story followed. The children were asked if they recalled having heard about Mimbos in the story and in which context. Then they were asked about the irises, what they were, and if the colour of Nandi's eyes changed. Care was taken to watch for the children's spontaneous recalls of the new term. Finally, the children were told that in two weeks the experimenter would come back to show them more pictures from the story. The whole Encoding Phase and the Test Phase of Experiment 3 took normally about an hour.

Posttest

The Posttesting took place two weeks after the initial experiment. The children were presented with four tests. First the experimenter read a short story to them in which Mimbo, Gombe, and the pixie were spoken of (see Appendix C, p. C1-C3). The same experimental materials that were presented in the Test Phase were presented again in the Posttesting.

Test 1. Sign Comprehension 2.

In Test 1, the children were presented with the plastic figures that had been presented in Test 1 in the Test Phase and were asked to hand them to the experimenter as requested (see Photo 4.1, p. 228).

Test 2. Object Comprehension 2.

The children were again shown the pictures that had been presented in Test 2 in the Test Phase and were asked to hand them over as the experimenter requested (see Photo 4.2, 4.3., p. 229-230).

Test 3. Production 2.

The children were presented with the layout that had been presented to them in the production test in The Test Phase and were asked to name the pictures (see Photo 4.4, p. 231).

Test 4. Category 2.

The children were asked what a Mimbo was and why they thought so. The experimenter asked, for example: "What do you think a Mimbo is?" Care was taken to watch out for spontaneous productions of the word in the children's recalls from the story. If the child hesitated and paused and could not answer directly, s/he was given the test sample of pictures from Test 2 in the Test Phase and asked to show which one was the Mimbo and was asked again: "What do you think a Mimbo is?" If s/he could not answer s/he was asked what a Mimbo looked like.

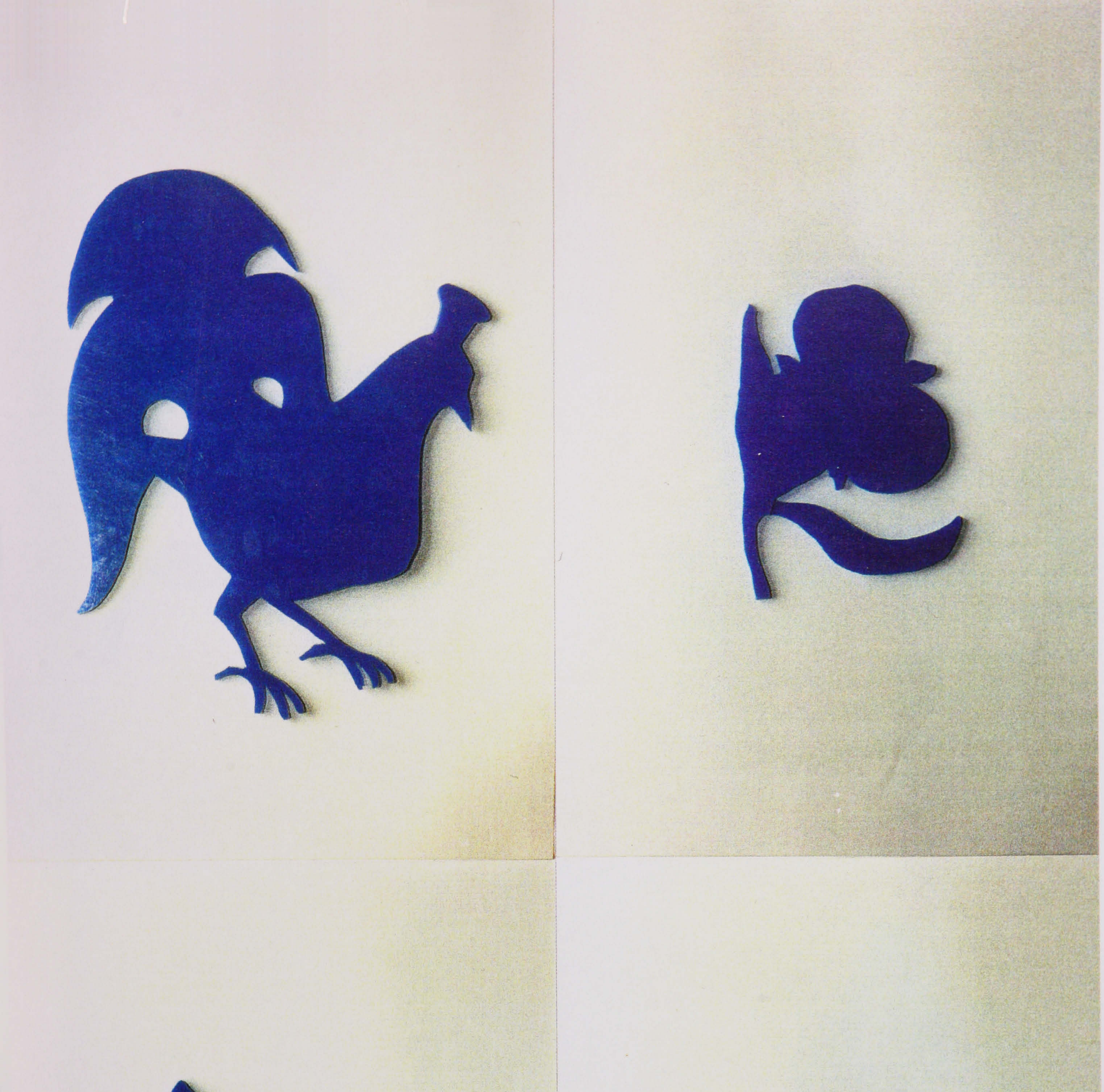


Photo 4.1. Sample Set of Blue Plates (Bird, Gombe, Mimbo, Mouse)

Photo 4.2. Sample Set of Pictures (Gombe, Iris, Fly, Mimbo)

Photo 4.3. Sample Set of pictures (Mouse, Bird)

Photo 4.4. Sample Set of Picture-Layout (Butterfly, Deer, Kelaph, Spider)

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Results.

In this section, I will discuss the data analysis for this experiment, first quantitatively and then qualitatively/descriptively.

First, I must clarify important issues in the behaviour of the children in the Encoding Phase and in the Test Phase, on basis of which, adjustments in the coding of their responses had to be made. As the experimenter continued with the testing, children who were not eager to respond at first made some responses later. This was in line with Reynell's (1977, 1983) expectancies. She had stressed the importance of continuing the presentation of test materials and the testing in order not to underscore the ability of young, unresponsive, or shy children.

The testing required a great deal from the experimenter and the children. I spent time getting acquainted with the children before starting the experiment. In the sample there were children from the morning and afternoon nursery in Dunblane who had participated in Experiment 2 and had performed well. They also did well in the present experiment. However, there were children from other places with whom I had faulty testing sessions. Examples of these were children from the Killin Playgroup, where the testing circumstances were not good. I presented the experiment and tested the children in a narrow kitchen with noise from the main playroom next door or I tested them in a storage room with very little space. Sometimes mothers were in the room with their children, and that may have affected the children's performance.

As expected, individual children showed qualitative variations towards the tests. For example, highly distractable and restless children appeared to find the drawing test, in which they were required to produce something themselves, easier than listening to the story and answering questions on the theme of the story, or to looking at the blue plastic plates and pictures. This was part of the hoped-for diagnostic values of the tests and was very likely a reflection of what happens normally in a standard test situation. Therefore, it was not possible to make a general rule about when to stop testing in cases in which the children could not complete a whole test. I had to make adaptations of the experiment to the level of the understanding of each child. Had I carried on with the strict testing procedure of always administering Test 1 first and separately, such a procedure would have been too complicated and confusing. It would have given a false picture of the true capabilities of young word-learners and would clearly have led to the underscoring of their abilities. The 4-year-old Indirects and the 4-year-old Controls were hesitant to co-operate and to continue without the modifications of the design. The 5-year-old children had Test 1 and Test 2 administered in the correct order, and separately. They worked with the same number of test items as did the younger children; this was expected to counterbalance for the older age group the bias created by the flexibility in the administration of the first two tests for the younger age group. However, if the older children got completely stuck with the plates in Test 1, they were given the pictures from Test 2 and later asked about the plates. But there were fewer older children who needed this procedure--roughly 30% of the total sample. When the contamination of the two first tests for both ages and both conditions is estimated, to work with the pictures first did not necessarily indicate that the child had mapped the new term properly, by selecting the appropriate referent or picture. Rather, working with the pictures mainly served to relieve the child's anxiety. Even if many children showed interest in the plates, they were quite passive when they were asked about them, but responded quickly, although not necessarily correctly, when presented with the pictures.

Use of pictures for young Indirect children in the Encoding Phase in Characteristics of Responses (see Table 4.4., p. 238) was reflected after the story section in which the "blue" Mimbo was mentioned. There was an increase in correct responses; the children may have made the instant connection between that which they heard and the blue picture of Mimbo with which they were presented in the Interval. The importance of auditory skills was also a clear factor.

The Indirect children's use of pictures in the Encoding Phase was counterbalanced by allowing the Controls in Test 1 to see both the pictures and the plates and to choose with which ones to start. Also, the younger Controls had only four pictures in the Test Phase with which to work, the same four as some of the Indirects had had in the Encoding Phase: Mimbo, mouse, bird, and Gombe. When the Indirects worked with the pictures in Test 2, they had two pictures added to these four: the fly and the iris. This procedure should have counterbalanced some of the bias stemming from having only four pictures for the young Indirects to work with in the four Intervals of the story. Also, to counterbalance the Indirects' acquaintance with the pictures, the Controls, who hesitated to answer, were asked, when they worked with the pictures and the plates: "Are you sure?" and were given second trials.

My mistake in the initial design for the experiment was to standardise it in the Pilot Testing with very adept children from the Psychology Department Playgroup and from Balquhidder Primary, who did not experience the same problems as did some of the subjects. The need for the adjustments did not emerge at the Pilot stage. Another mistake was to regard the plates as similar to the signs used in Experiment 2. But the signs were picturesque outlines, caricatures of natural kind things with some features such as eyes, and with some details emphasised because of a white background coming through; whereas the blue plates were only solid shapes with outlines and with no contrasts between the outlines and the interior and could be taken to represent unspecified natural kinds in each conceptual domain. Thus, the plates showed a lack of features--features that may be needed for young children to make proper discriminations and conceptual mappings. Had there been eyes or other facial features on the animal plates, these features might have elicited a different reaction in the children. Besides, complex patterns or forms may be more interesting to young children than are simple, basic ones (cf. Bryant, 1974).

The scoring for the first two tests in the experiment is, therefore, grounded on more subjectively based circumstance than is the scoring in Experiment 1 and 2. In Experiment 3, the needs of each individual child were taken into account. The design was modified according to his or her behaviour towards test items, whether s/he was passive (pausing, and showing no co-operation, as often happened with the plates), or was active, enthusiastic, and motivated. The scoring in Test 1, Sign Comprehension, and Test 2, Object Comprehension is not based on a strict, objective criterion. I regard the two first tests, therefore, as Pretests to the actual testing that took place in Test 3, Production, Test 4, Depiction, Test 5, Category.

A Quantitative Analysis of the Data.

The quantitative analysis of the data is based on calculations of the raw scores of 1 for correct answers and 0 for wrong or no answers. Various statistical tests have been run in order to arrive at the final analysis of the two main variables under study, Age and Intervention: Chi Squares, t-tests, mean tables, Anovas, and the Duncan Multiple Ranges Test.

The tests of the experiment were designed so as to test for sense, denotation, and reference of the new term. The tests revealed that in Experiment 3 neither Age nor Condition reached significance levels. Some children reached full mapping of the new term--children in both age groups and in both conditions. The results from the Indirects and Controls were nearly homogenous in terms of quantitative products in Test 1, Sign Comprehension, and in Test 2, Object Comprehension. Both these tests were pretests to the real testing; there were 60 to 75% correct scores for all possible total scores for both ages.

As mentioned earlier, children in both the conditions had access to pictures if they showed uncertainty towards the plates. Control children also were allowed second trials if they were hesitant and unsure. However, there were both young Indirect and Control children--roughly 30% of the sample--who went through the standard procedure of working first, and separately, with the plates and then with the pictures and did very well. Thus, I have included in this result section only the results from the three later tests of the Test Phase: Test 3, 4, and 5. These tests were administered in the same manner to all children. Results from the first two tests can be seen in Appendix C, p. C10.

The result section starts with tables showing characteristics of responses during the Encoding Phase, then patterns of within-children/between-children responses in the Test Phase are shown, followed by individual between-groups comparisons for the different tests together with a correlation matrix for the tests, and, finally, effects of age and condition on performance are presented.

Characteristics of Responses during Encoding

In Table 4.4. (p. 238), the correct responses to the new term during the Encoding Phase are presented. It should be noted, however, that there were children in both age groups who did not try to give a symbol/object from the sample set over when asked for it by the name "Mimbo." The labels "S1" to "S4" are category labels for the four sections of the story and "T1" labels the first test in the Test Phase.

Table 4.4. - Experiment 3

Indirects - Correct Responses during Encoding.

Age	*S1*	*S2*	*S3*	*S4*	*T1*
4	*5*	*6*	*10*	*9*	*10*
5	*8*	*9*	*9*	*7*	*8*

N=36

Patterns of Within-Children/Between-Children responses.

In order that the patterns of within-children/between-children responses could be estimated, the raw scores were calculated as percentages of the possible total scores for each group, in which N = 18. Results from T3 (Production) and T4 (Depiction) are presented in the following bar graphs (p. 240-241). Results from T3 to T5 in the Test Phase can be seen in Table C.1., Appendix C, p. C5. As stated earlier, the first two tests in the Test Phase were treated as pretests to the actual testing. In these two tests, the correct scores were for both conditions and ages: 60 to 75% correct for the total possible correct answers.

Figure 4.1.

Percentages of Correct Responses for Age and Condition.

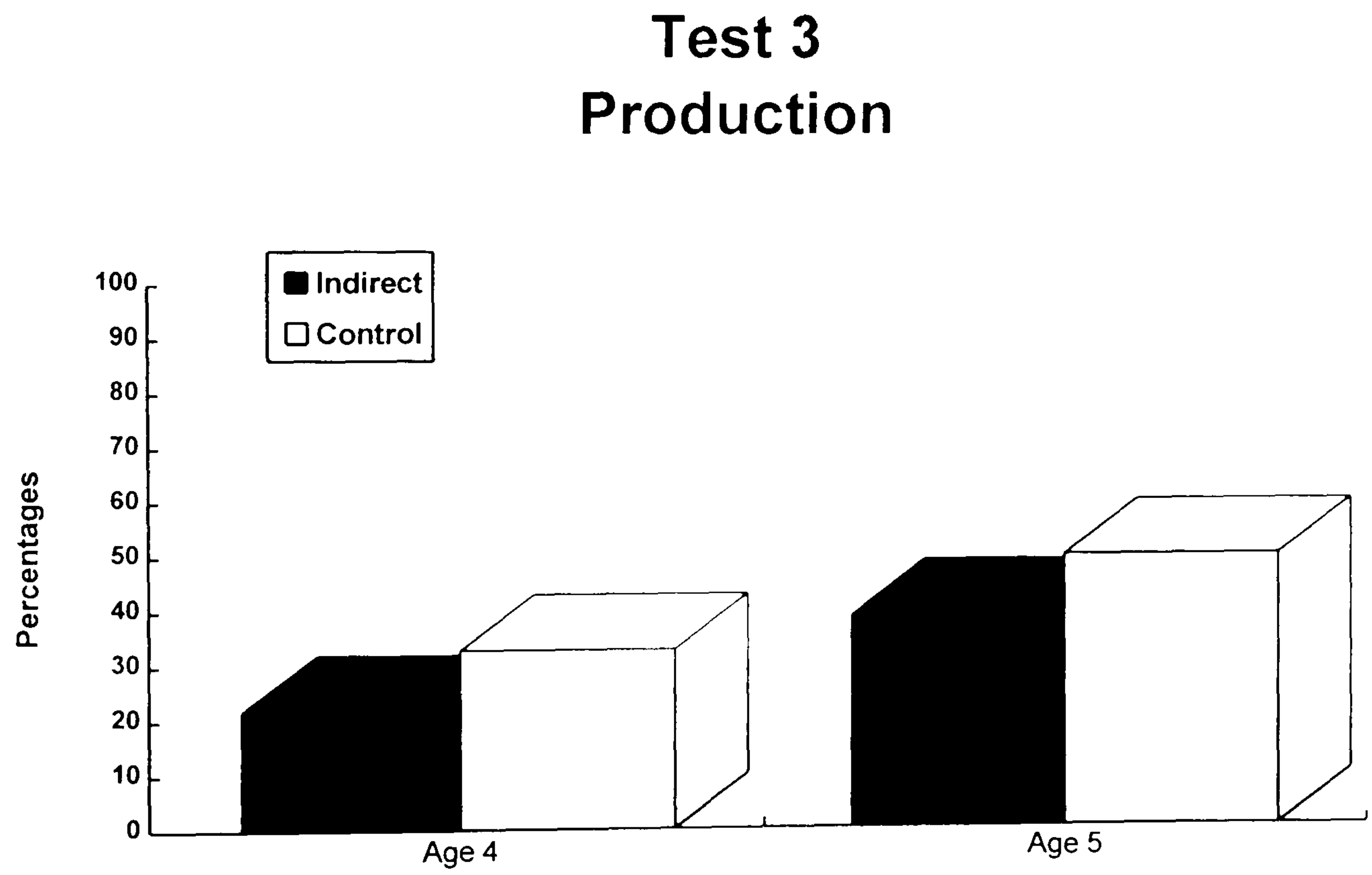
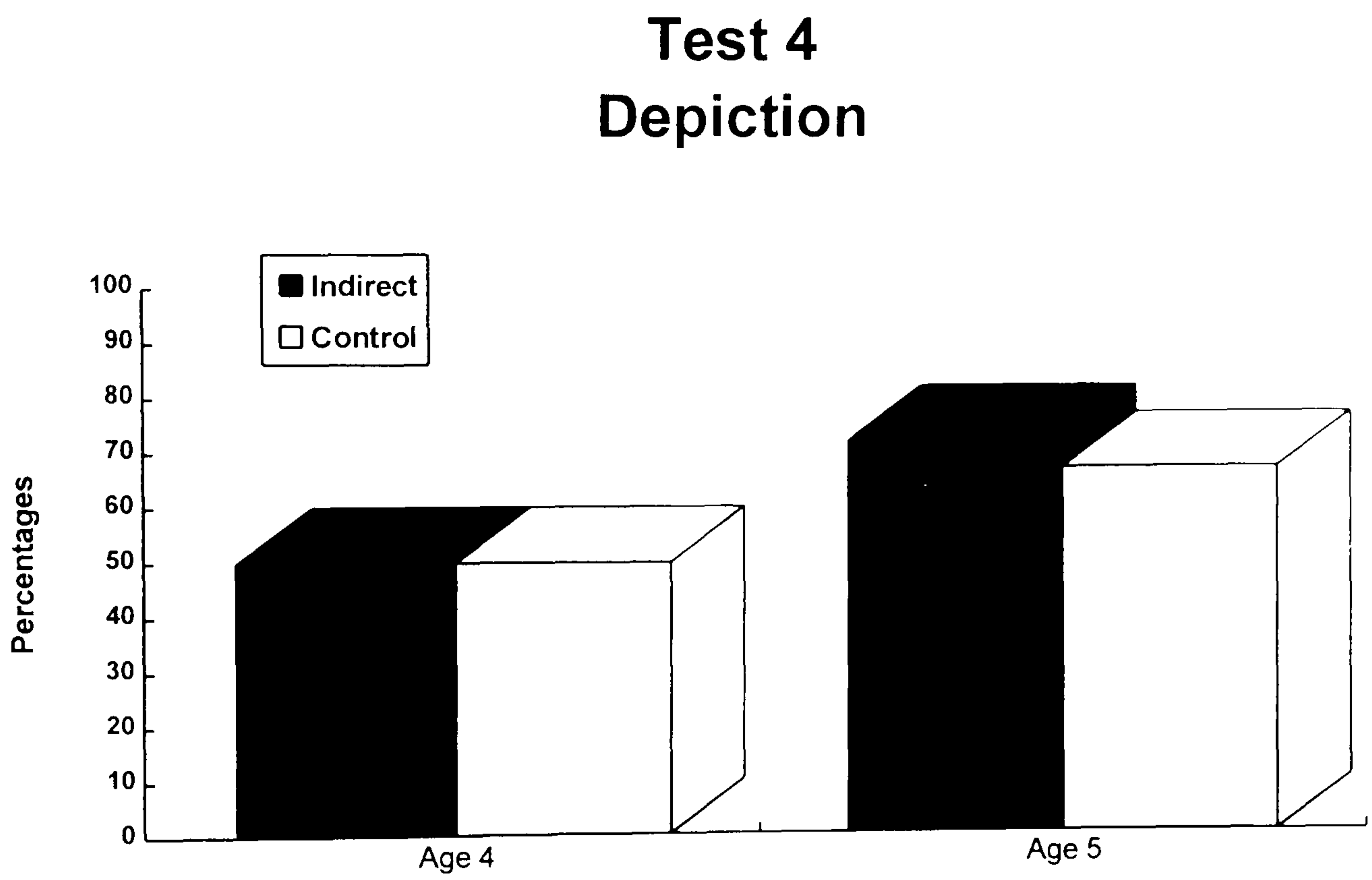


Figure 4.2.

Percentages of Correct Responses for Age and Condition.



Individual Between-Groups Comparisons for the Tests in the Test Phase.

The different tests reveal interesting age-related developmental variations and the effects of different encoding procedures in the sample; by using individual between-groups comparisons, employing the Duncan Multiple Ranges Test, the significance in performance is confirmed between the conditions and between the ages for the various tests in the Test Phase.

Test 3 - Production.

The Duncan Multiple Range Test confirms no significant difference between the conditions, Control condition (M .42) and Indirect condition (M .31) at the .50 level and no significant difference between age 5 (M .44) and age 4 (M .28) at the .050 level.

Test 4 - Depiction

The Duncan Multiple Range Test confirms no significant difference between the conditions, Indirect condition (M .64), and the Control condition (M .58) at the .50 level and no significant difference between age 5 (M .69) and age 4 (M .53) at the .050 level.

Test 5 - Category.

The Duncan Multiple Range Test confirms no significant difference between the conditions, Indirect condition (M .53), and Control condition (M .67) at the .050 level and no significant difference between age 5 (M .64) and age 4 (M .55) at the .50 level.

(See Appendix C, Table C.2., p. C7, for the means and STD for condition and age for T1-T5 with the Duncan Multiple Ranges Test).

The following **correlation matrix** (See Table 4.5., p. 243) shows strong **correlation** *among some of the tests:* the strongest correlation among Test 4 (Depiction) and Test 5 (Category) (.56**); then, among Test 1 (Sign Comprehension) and Test 2 (Object Comprehension) (.53**), and, finally, among Test 3 (Production) to Test1 (Object Comprehension) (.32*), and a similar correlation to Test 5 (Category) (.32*) and Test 4 (Depiction) (.3o*). (See more in Discussion on the revelations of the tests, p. 275).

Table 4.5

Correlation Matrix for the Tests in the Test Phase in Experiment 3.

Correlations:	SICOM	OBCOM	PROD	DEPIC	CATEG
SICOM	1.0000	.5272**	.1252	.1234	.2743
OBCOM	.5272**	1.0000	.3244*	.2307	.2080
PROD	.1252	.3244*	1.0000	.3032*	.3226*
DEPIC	.1234	.2307	.3032*	1.0000	.5648**
CATEG	.2743	.2080	.3226*	.5648**	1.0000

N of cases: 72 2-tailed Signif: * - .01 ** - .001

Effects of Age and Condition on Performance.

The following is Two-way Analysis of Variance (Two-way Anova) showing effects of Age and Condition on performance in the different tests in the Test Phase. Anova tables and mean tables for these tests are presented in Appendix C, Table C.4., C.5., p. C12-C19.

Test 3 (Production).

Two-way Anova shows no significant main effects of Age and Condition. Age group 5.6 performed better overall. In both age groups, subjects in the Control condition performed best.

Test 4 (Depiction).

Two-way Anova shows no significant main effects of Age and Condition. Age group 5.6 performed better overall. In both age groups, the Indirect condition performed better.

Test 5 (Category).

Two-way Anova shows no significant main effects of Age and Condition. Age group 5.6 performed better overall. In both age groups, the Control condition performed better.

Combined Tests.

The following are combined tests, the results of which have been calculated from the means of each of a given subtest (T1: Sign Comprehension, T2: Object Comprehension, T3: Production, T4: Depiction, and T5: Category) in the Test Phase (see p. 223-226 for a full description of the tests). The results of three such combined tests are presented here. These tests have been named *Full Meaning*, *Comprehension*, and *Verbal Concept*. It should be noted that the names of these combined tests indicate that in *Full Meaning*, a child who has all the subtests correct has worked out the full meaning of the new term as s/he has mastered both the comprehension and production of the new term; whereas a child who has one or more of the subtests wrong has only a partial meaning for the new term. In *Comprehension*, the test of Production (T3) has been omitted, and as the remaining four tests are testing for comprehension and a blend of linguistic and nonlinguistic knowledge, a child who has all four of them correct can be granted with a general understanding of the new term and with some linguistic understanding--but not a full meaning yet--as s/he has difficulties in recalling it, a procedure that may be of a more semantic content than the one of understanding. Finally, the combined test of *Verbal Concept* is based on the results from the tests of Sign Comprehension (T1), Object Comprehension (T2) and Category (T5), all of which test for verbal comprehension.

Full Meaning (Test 1 - Test 5).

Two-way Anova shows no significant main effects of Age and Condition.Age group 5.6 performed better overall. In both age groups, the Control condition performed better.

Comprehension (Test 1, Test 2, Test 4 and Test 5).

Two-way Anova shows no significant main effects of Age and Condition. Age group 5.6 performed better overall. In both tests, the Control condition performed better.

Verbal Concept (Test 1, Test 2 and Test 5).

Two-way Anova shows no significant main effects of Age and Condition. Age group 4.4 performed better overall. In both age groups, the Control condition performed better.

The following graphs (Fig. 4.3., 4.4., 4.5., p. 246-248) present effects of age and condition on performance in Full Meaning (T1-T5), Comprehension (T1+T2+T4+T5) and Verbal Concept (T1+T2+T5).

Results from the other tests and posttests, mean tables, Anovas and Duncan Multiple Ranges are in Appendix C, Table C.4., C.5., p. C12-C19.

Figure 4.3. Effects of Age and Condition on performance in Full Meaning

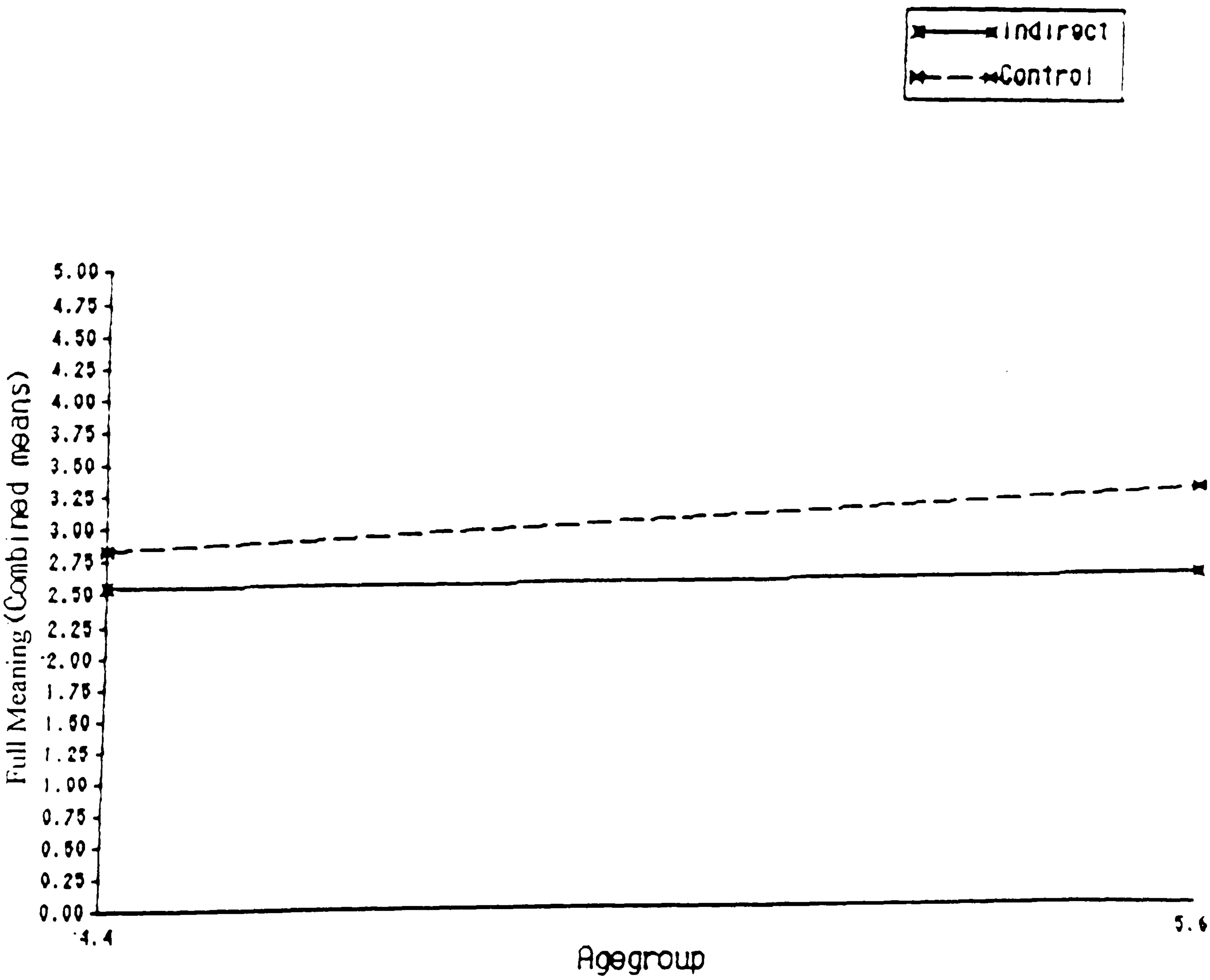


Figure 4.4. Effects of Age and Condition on performance in Comprehension

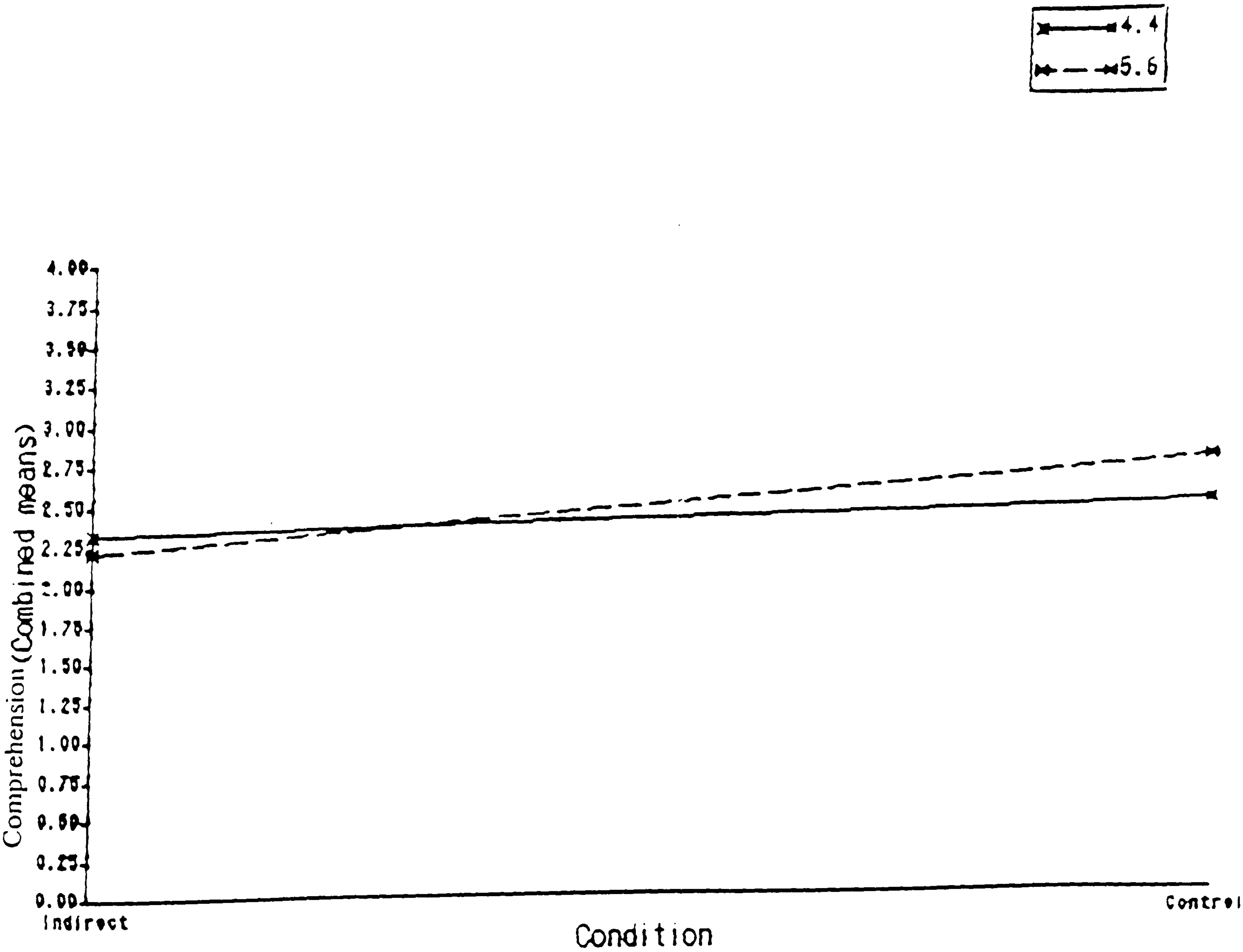
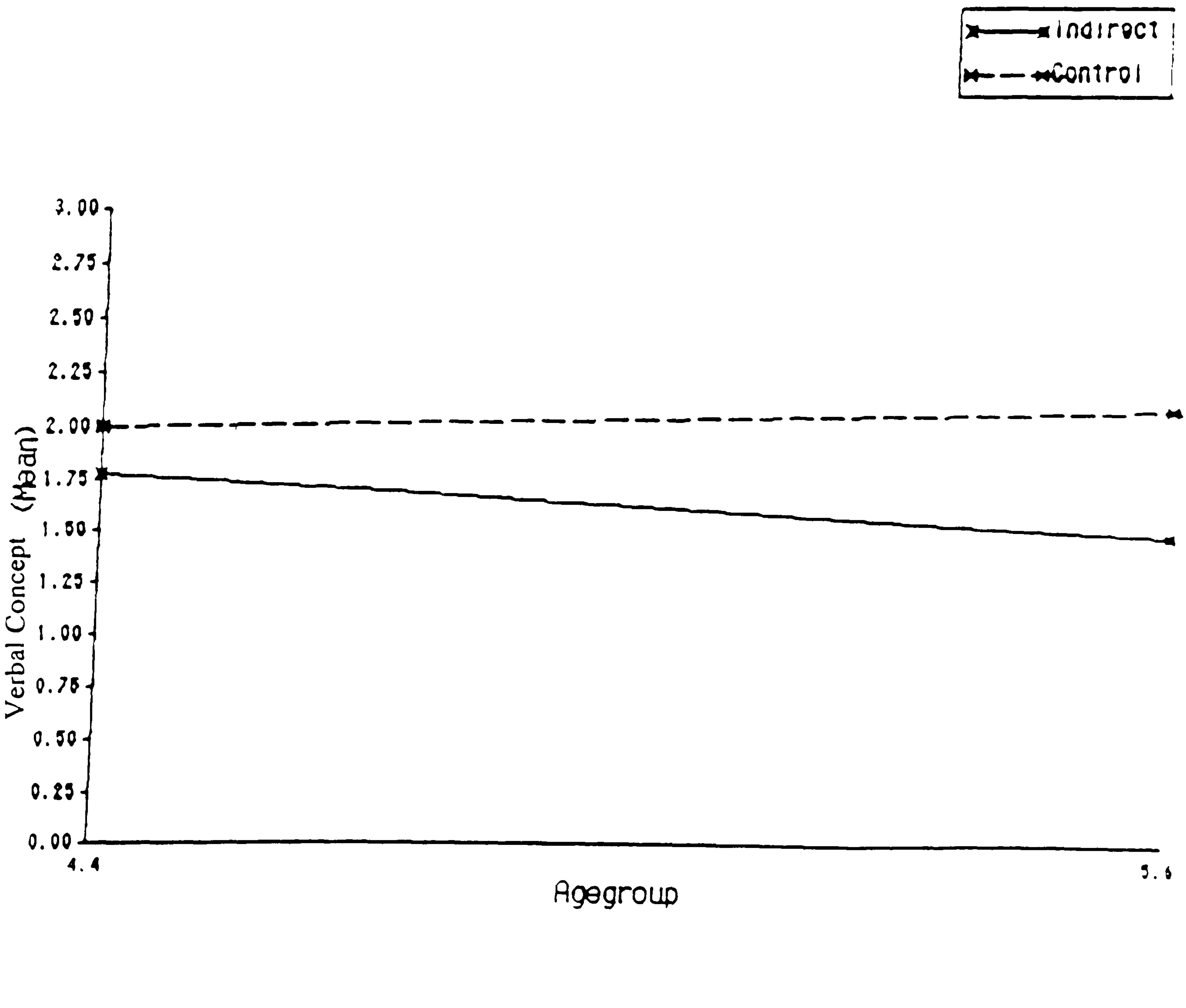


Figure 4.5. Effects of Age and Condition on performance in Verbal Concept



A Qualitative Analysis of the Data.

The sign/object relationship occurs in the course of mental development in children. It is thought to evolve in three stages: perception, imagination, and conception. Bruner (1964) has argued for the sequence of stages in the development of intelligence. He termed the stages enactive, iconic, and symbolic phases. In the enactive phase, the child knows the world through habitual actions that presuppose an active and direct contact with the world; in the iconic phase, a new form of representation is developed in the form of "imagery": and in the symbolic phase, actions and images are translated into language. All these phases leave traces and have a dynamic interplay in the various phases of development through life.

Krampen (1991) maintains that perception is involved in the earlier phase of the sign/object relationship. Imagination and conception he labels together as "representation," implying two later stages of that development. Krampen further maintains that at the level of perception, the sign (signifier) consists of sense data that are constituted by different views of, or contacts with, the same object. The object or the signified is the "constant object" seen from its various perspectives. At the level of imagination, the signifier is the symbolic representation of the mental image of an object, the signified is the internalised imitation of the perceptual activity necessary for grasping an object in its complexity. At the level of conception, Krampen holds that the signifier is the sign, the verbal representation of objects or processes, and that the signified is the internal operation on symbolic objects constituted in classes or as spatial systems. He maintains that the final stage of development--conception-- and the two previous stages--perception and imagination--imply a high degree of abstraction. Donaldson (1978, 1992) has argued that for children to grow from context embeddedness to decontextualisation in their thinking is a developmental process that takes time.

I will now give descriptions of the main trends in the children's responses in the two conditions: the Indirect condition and the Control condition that were employed in Experiment 3. The idiosyncrasy of the children's responses was an outstanding feature in their data and so was the variety of coding schemas that they used in their mappings of the meaning of the new word. As in the two earlier experiments, their natural heuristics for mapping new words seemed to involve two main processes: a) the tacit, instantaneous conceptual mappings of the underlying category of the new word and b) the subconscious connotations for the word in which comparisons to similar kinds seem to be based on memory for instances used as contextual determinants, such as saying: "It's all blue," "It looks like a slug," and "The bird ate it." As the response patterns showed, there were children who adhered to a trial-and-error strategy when they dealt with the interferences of their conditions. Other children made use of learning opportunities provided by these same interferences and still other children relied on their linguistic skills and intuitions and overcame the difficulties of their situation.

The Indirect condition.

The Indirect children used a strategy of pre-emption if they knew three out of four referents and mapped the unknown word, "Mimbo," to the unknown referent in the sample. Usually they knew only two referents and a strategy of pre-emption did not work for them. However, there were Indirect children who clearly learned from the opportunities provided by repeated encounters with the stimuli materials. There were strong individual differences in whether the opportunities were learning opportunities or sources of greater confusions, in which the children continued with their trial-and-error testing. The Indirect children were helped to set up a semantic frame when they were asked: "Can you now give me the Mimbo?" The children's own non-linguistic biases and predispositions that they brought with them to the task may have led them to pay little attention to explicit linguistic contrasts provided in the input. If the children felt, for example, that "Gombe" was an unfamiliar token of a type for which they had a name, they might have applied "Mimbo" to it. Thus, they would have ignored the information in the input for forming hypotheses about the meanings of the new word, "Mimbo." The worm-like creature may thus have been a familiar token of a type for which the children still had no name but their biases led them astray when they decided instead on "Gombe."

The context of a given study in which children hear a word, clearly makes a difference in their first hypotheses about the word. In the Indirect condition in Experiment

3, the children received practice in working out the extension of the new concept by providing the children with contacts with the stimuli materials throughout the experiment. The children's predispositions and preferences may have been a variable that interfered with their more idiosyncratic responses being eliminated in the course of their processing of the linguistic information of the story.

The problem that the Indirects had may have been more of a semantic problem than a conceptual problem. More unknown names, such as "Mimbo" and "Gombe," may have created greater confusion than did the underlying conceptual categories for these two names. There were children who opted for Gombe over Mimbo if they failed to identify the unknown target referent by use of the linguistic information available and thereby made a semantic mistake. Thus the Indirects were trapped by compounding their real-world knowledge with their semantic knowledge. I think that the plates proved difficult for both conditions because they were not differentiated enough with identifiable features such as eyes. Furthermore, they did not look unfamiliar enough, so that the problem with Mimbo was a problem of dealing with synonyms. If the children felt that they already had a name for all the animals in the sample, including Mimbo, they were easily confused. Therefore, they may have adhered to a trial-and-error strategy with mismappings. The pictures possibly showed more unfamiliar-looking referents; therefore the children did not already have names for all the animals and were motivated to work with the pictures, even if they did not map the new name properly.

Quite a few children in the 4-year age group got Mimbo right during the Encoding Phase. However, the stimulus material of the plastic plates was, as mentioned earlier, rather puzzling to many children. The most common mistake was to hand the experimenter Gombe when she asked for Mimbo and vice verse. There were also children who took the bird for Mimbo. The following is an example of Indirect testing from the experiment with Mark (age 3.9), who was tested with the word "Kelaph":

Section 1.

Points to the Kelaph

Points to Gombe

Points to the mouse

Points to the bird.

Section 2.

Points to the mouse

Points to the Kelaph for the Gombe

Points to the gombes for the Kelaph

Points to the bird correctly.

Section 3.

Points straight to Gombe for the Kelaph.

Points to the bird correctly

Points to the mouse correctly

Points to the Kelaphs for the Gombe.

Section 4.

Points to Gombe

Points to bird

Points to mouse

Points to Kelaph, and says Kelaph at the same time.

All correct.

Test 1.

E: One of these is a Kelaph, can you show me which one ?

S: Shows it.

Shows all others correctly.

Test 2.

Does them all correctly

Test 3.

Says toadstool pairs for the gombes

E: What can you do with them ?

S: You just sit on the top and then it falls off, and if they fall off, old man grumble comes...

Names all items except the Kelaph, does not know, he says.

Says now apples for the gombes.

Test 4.

E: Can you now draw me a Kelaph ?

S: I could. Well, not really, he says after some thought.

E: It doesn't have to be perfect.

S: Yeah. Starts to draw and says as he draws: But they have heads and tails and now he hesitates.

E: Can you try ?

S: They have very big heads like that, he shows the E what he is drawing, then they have very big eyes.

I could draw something else here, he says when he has finished.

This one is a bit grabby and dirty, he says when he has finished the picture and shows it to E.

Test 5.

E: Can you tell me what a Kelaph is?

S: It looks like a worm.

Posttest.

Test 1.

Points to the bird for the Gombe

Points to the Kelaph correctly

Points to the mouse correctly

When asked if he remembers where the Kelaphs lived, he says Kelaph in the sand.

Test 2.

All correctly except he mixes Kelaph and Gombe.

Test 3.

When first asked about the Kelaph, he is hesitant and he is shown the figures, but he looks over to the pictures, and takes the Kelaph one. Cannot say Kelaph and Gombe.

Test 4.

E: Can you tell me what a Kelaph is?

S: It's a worm.

Those children who never corrected themselves in the Encoding Phase tended to repeat their error through all the tests and posttests. There were children who were always mixing bird, Mimbo, and Gombe. They clearly went through a good deal of trial-and-error sorting. Some of these 4-year-old children were quite passive. However, they seemed to enjoy the story itself.

The 5-year-old children often thought aloud and used facial expressions when answering. They looked at the experimenter for approval or reassurance. The following is an example of Indirect testing with Catherine (5.2), who was tested on the word "Kelaph":

Section 1.

When asked about the Kelaph, she takes good time to look at all over and over again, that one, she then says, and shows Gombe.

Bird

Kelaph for Gombe

Mouse.

Section 2.

She listens very attentively.

Gives mouse correctly.

Gombe, that one and gives Kelaph

Kelaph, that one and gives Gombe

Bird.

Section 3.

S: Kelaph, that one, she is now very quick as if she has made a sudden realisation and gives it correctly.

Gives Bird correctly.

Gives Gombe correctly.

Gives Mouse correctly.

Section 4.

Mouse

Kelaph for Gombe

Bird

Gombe for Kelaph.

She listens very attentively to the story all the time.

Test 1.

Gives the Kelaph correctly, but is hesitant.

Gives mouse correctly.

Gives Gombe correctly.

Gives bird correctly.

Test 2.

She hesitates and looks at all, then points to the Kelaph.

Bird

Mouse

Flower

Fly for Gombe

Test 3.

Bird

Sun

The rainbow

A fly for Kelaph

A tree

Long pause for the fly, no response

Boy for the elf

Mouse

Mushrooms

Flower

Long pause for the Gombe, no response

Fairy

Pause for Nandi

Test 4.

E: Can you now draw me a Kelaph ?

S: Draws something red that could pass for the Gombe. A very well drawn picture.

Test 5.

E: What is a Kelaph ?

S: An animal.

Posttest.

Test 1.

That one, she says and shows the Kelaph immediately.

Shows other items correctly.

Test 2.

Shows the flower all of a sudden for Kelaph.

Bird

Mouse

Kelaph for Gombe

Gombe for flower.

Hesitates when it comes to the fly, was going to give it, looks at experimenter, but stops giving it.

Test 3.

Names all except Gombe and Kelaph.

Test 4.

E: What is a Kelaph ?

S: Pause.

E: Is it an animal, a bird, or a flower ?

S: Flower, she then says.

Like the younger children they usually make mismatches between either Mimbo and Gombe or Mimbo and bird and some confused all three. This was an error pattern that they tended to repeat in the tests later. There were children who realised their error and it became clear that if there had been recovery already in the Encoding Phase these children did well in the tests later.

The Control condition.

In the Control condition, the new term was embedded in a continuous text and the information to the denotation of the term was indirect. If children in the Control condition knew very little of the topic of the story that gave the context for Mimbo, they faced difficulties in making the "bridging" inferences necessary to understand sentences assuming that knowledge. Pre-emption may have been a problem in this condition, since the children may have known what was occurring in the story without the need to make any inferences about the target word. They could make a global sense of the story situation without doing so. Then the problem of pre-emption might not arise at all, since the children could listen to the whole story without the need to objectify their thinking, so as to consider word-object pairing. Their responses reflected information that they had chosen and regarded as salient. By allowing a passage of time between the children's first encounter with the target word and their subsequent encounters, there was the likelihood that the time allowed resulted in the children's considerable modification of the retained information, with their more idiosyncratic responses being eliminated. Thus, the Control condition allowed continuity and a final global assessment after a unified presentation, with interfering questions only on the theme of the story. The Control children had more time to learn about subject matter, but not as much practice as did the Indirects in establishing reference. This deficit was reflected in the hesitations that the Controls had with the test materials when they saw them first. They had difficulties co-ordinating their information with the sample of referents with which they were presented in the Test Phase. In case of the youngest children, I felt that it was necessary to make adaptations in the testing to meet their level of understanding. Therefore, I gave some prompts to children in both age groups and conditions. I gave Controls encouragements such as: "Are you not sure?", "Do you want to try again?" if they were hesitant when they were presented with the test materials in Test 1 and 2 and I related the questions to the story when I asked the children to hand over the Mimbo, by saying things like: "Mimbo, like the one in the story."

In the youngest age group in this condition there was much individual variation in listening abilities and attention. However, even with children who had to talk to the experimenter or remark on something that they saw on the screen while the woman was reading the story, they seldom showed restlessness or started other activities. The following is an example of Control testing with Steven (age 3.10), who was tested on the word "Mikas":

Section 1.

When he comes over to the test room he remarks: Hey, that's Maureen and screams and points to the tape. (Maureen was the woman reading the story).

E: Where did the little pixie, Nandi, in the story, live ?

S: Pause.

E: In a big forest ?

S: Yes.

E: Whom was he working for ?

S: Pause.

E: A fairy queen ?

S: Yes.

E: Did he pick berries, flowers, or mushrooms ?

S: Flowers.

Section 2.

E: Did you hear what Nandi was worried about ?

S: Pause.

E: Was he worried about his eyes?

S: Yeah.

E: Do you remember what was wrong with his eyes ?

S: Pause.

E: Was one eye blue..?

S: And one eye was brown, he adds and fills in the sentence.

Section 3.

E: Did Wise Elf have a magic wand ?

S: Yes.

E: Did wise elf use his magic wand or say something strange ?

S: Yeah.

E: How did Nandi feel about that ?

S: Pause.

E: Bad ?

S: Yeah.

E: Did wise elf slam the door ?

S: Yeah.

Section 4.

E: Did the fairy queen come to see Nandi in his sleep ?

S: Yeah.

E: What did she tell him ?

S: Pause.

E: Not to worry ?

S: Yeah.

E: Did Nandi sing ?

S: Yeah.

E: Did the fairy queen say something about his irises ?

S: Yeah.

E: What are the irises ?

S: It's the eye.

Test 1.

He points to the Mimbo immediately.

Other items correct.

Test 2.

Which one is the Mimbo?

That one, he says and points to bird.

Mouse for Gombe

Gombe for mouse

Fly correctly.

Mimbo for bird.

Test 3.

He recognises Mimbo but can't say the name

A hen

A man for the elf

An apple for the flower

Fairies for Gombe

Don't know for fairy queen

The boy that slams the door, points to the queen

Grapes for the mushroom

All other ones correct.

He is asked again for the name of the Mimbo and he says now: a fairy.

Test 4.

E: Can you now draw me a Mimbo?

S: I can't really.

E: It does not have to look perfect.

S: Now he starts to draw it. Draws a blue Mimbo.

E: What is this?

S: Pause.

S: That's it, one eye blue, and one eye brown, he says.

Test 5.

E: Can you now tell me what a Mimbo is?

S: A worm.

Posttesting.

Test 1.

E: Where is the Mimbo now ?

S: My Mimbo is going to be a caterpillar, this one, points to it now correctly.

What one is that one ? he asks for the bird.

Mouse correct

Gombe correct.

Test 2.

Points to Fly correctly.

Points to iris correctly.

Points over to bird for the Mimbo.

Points to Gombe correctly.

I have never seen these, he remarks about the Gombe

Mouse correct

Mimbo is left, he realises something is wrong but does not correct it.

Test 3.

Says caterpillar for the Mimbo

Says fly

Says rat for mouse

Don't know what it is, he says for the flower. It looks like a hen, he says for the flower

A cocadoodledoo for the bird

Looks like a fly for the Gombe.

Other items correct.

Test 4.

What is a Mimbo?

Pause.

A worm. It looks like a caterpillar, he remarks when he sees the pictures.

There were children who gained some global sense of the story but could not be very specific about events or the story line. Other children only answered with "Yes" or "No" and the experimenter sometimes had to simplify her questions to give these children a feeling of confidence. There were also children who did not report on anything in the story and paused every time they were asked a question.

Some of the 5-year-old children could give a decent report on the story; others compensated with their own imagination when their memory failed; but most of the time their guesses were within the global sense of the story. The following is an example of Control testing with Patricia (age 5.9), who was tested with the word "Mimbo":

Section 1.

E: Where did Nandi live ?

S: Pause.

E: Did he live in a big field or a big wood?

S: Wood.

E: Was he picking something in the wood?

S: Yes.

E: Can you tell me what he was picking?

S: Mushrooms.

E: For whom was Nandi working?

S: Pause. Can't remember.

Section 2.

E: Was there something strange with Nandi's eyes ?

S: Yeah.

E: Can you tell me ?

S: One was brown and one was blue.

E: Did Nandi use his own magic wand to change his eyes ?

S: Pause.

E: Did he try to use it ?

S: Pause.

E: Did his blue eye stay blue or turn brown ?

S: Stayed blue.

Section 3.

E: Did Nandi go somewhere for help ?

S: Pause.

E: Did he go to see wise elf ?

S: Pause.

E: Could wise elf change Nandi's blue eye?

S: No.

E: Did he say something about Nandi's irises?

S: Yes.

Section 4.

She listens extremely attentive to the story all the time.

Gives few responses to part 4.

Test 1.

Bird

Mimbo, immediately

Gombe

Mouse.

Test 2.

Mouse

Bird

Mimbo.

Fly for Gombe

Flower

Gombe for fly

Test 3.

Almost all items correct except elf.

An old--? (for elf)

An old man for elf.

Mi- for Mimbo.

Berries for Gombe

E: Do you know the name of these berries ?

S: No.

Boy in the story for Nandi.

E: Do you remember his name ?

S: Yes. I can't remember.

Test 4.

E: Can you now draw me a Mimbo ?

S: She starts to draw it immediately.

She starts with the head and takes good care at drawing well.

E: What is a Mimbo ?

S: Pause.

E: What does it look like?

S: Like a caterpillar, she replies.

Test 5.

E: Did you hear about the Mimbos in the story ?

S: Yeah.

E: Where did the Mimbos live ?

S: A hedge, she says.

E: Do you remember the colour of the Mimbos in the story ?

S: Blue

E: What did the Mimbos eat for example ?

S: Leaves.

E: What do the Mimbos look like?

S: Look like a snail.

E: Have you heard about Mimbos before ?

S: Yeah, nods.

E: Did you hear about Nandi's irises ?

S: Yes.

E: What are they used for ?

S: Seeing.

E: What is the colour of your irises ?

S: Blue.

Posttest.

Test 1.

Shows the Mimbo immediately

Other items correct.

Test 2.

Shows the Mimbo correctly and all other items.

Test 3.

Says Mimbo clearly

Mouse

Bird

Pause for Gombe.

Test 4.

E: What is a Mimbo ?

S: A worm.

E: Did Nandi's eye stay blue or turn brown?

S: It stayed.

The older Control children remembered more about main characters and events than did the younger Controls. These older children used much body language and often seemed to speak to themselves silently.

Children in both the 4- and 5-year groups appeared to look to the experimenter for support and affirmative answers. They said, for example, "Don't you think?" "Isn't it?" and "What was he doing?" The last section of the story proved difficult for both these age groups; they tended to slip back and pause and did not all follow what was happening in the section. There were cases in which the experimenter had to stop the tape in the midst of the section and start the prologue to the Test Phase. This required allowing the children to handle the plates and pictures if necessary.

The Representational Ability of Young Children as Expressed in Drawings.

I will finish this descriptive analysis with a short section on the drawings of the children in the experiment. There were drawings produced in the experiment, which I have included here (see Fig. 4.6., 4.7., 4.8., p. 271-273) that I find to be outstanding examples of the ability of young children to express their procedural knowledge in more detail than I would have thought them to be capable. The drawings were more symbolic than I had expected. However, I had predicted that even for such young children, to look initially at the plates and pictures and handling them would influence their motor copy of the referent.

As stated in Thomas and Silk (1990, p. 34-39) Luquet (1927) has argued that behind the development of the drawings of children, was a tendency towards realism. He advanced a theory on the sequence of five phases in drawing development: scribbling (age 2 to 3), fortuitous realism denoting the discovery of certain features of scribbles and objects in reality (age 3 to 4), failed realism entailing synthetic incapacity (age 4 to 5), intellectual realism, a stage in which children draw what they "know" about reality such as when they draw that which is inside a car as well as its outward looks (ages 5 to 8), and visual realism, a stage in which children draw that which is visible only from a certain point of view in reality, with a certain perspective (ages 8 to 12).

Krampen (1991) maintains that children's drawings issue from a mental image. He further maintains that this image is a particular form of signal coding and that it constitutes an assimilation rather than a copy, by being the result of a translation into a code that preserves the structure of the spatiotemporal pattern present in the stimulus object. Thus, Krampen argues that the process of signal transformation during perception is not at all conceived of as passive. He regards it as 'perceptive action,' also involving effect or movements, such as hand movements while touching an object or eye movements following the outline of a figure.

Krampen (1991) maintains that the French psychologist Liliane Lurçat together with her coworker already in the late fifties had spoken of a "visual geometry," including reading, writing, and geometry, in her hypothesis on the development of graphic activity.

Lurçat argued for the common origin of images in drawing and signs in writing, which would separate in the course of development (see Krampen, 1991, p. 47-48).

Drawings, for Lurçat, in the sense of iconic representations of objects and scenes, are seen as being part of a more general graphic activity. This general graphic activity comprises scribbling, early foreshadowings of writing, and the first attempts at drawing letters or writing. Graphic activity, even if a unitary activity at first, begins to split into two functions between the age of 4 and 5: symbolic (or iconic) representation and writing with conventional signs. According to her suggestions, the children in Experiment 3 should be at these stages (see Krampen, 1991, p. 61-62 and p. 121-122).

The same general effects of encoding on the drawings were noted in Experiment 3 as in Experiment 1 and 2. There were more Indirects who were stimulus-bound in their drawings, or asked for the plates or pictures to copy, and there were individual differences in whether they asked for a plate or a picture to copy. The drawings of the Controls were not as stimulus-bound. There was a trend of less stimulus-bound drawings in their group as in the two earlier experiments. The Control children drew from memory more often than did the other subjects, and I think the reason they produced somewhat fewer drawings than did the Indirect children was because of the difficulty for children as young as four to draw from memory.

The drawings were scored by the experimenter on the basis of how they looked and on the basis of what the child said about his or her drawing when they were producing it. Many children in the younger age group chatted aloud as they were making their picture. It is important to note that when the child was asked later what a Mimbo was, s/he was given choices if s/he could not answer such a direct question. If the children were still not able to answer, they were asked how Mimbo looked. There were children who had drawn a worm-like creature but who said something other than "worm" for Mimbo when asked to categorise it. There were also children who had drawn something other than a worm-like creature but could define or describe Mimbo properly. This shows that there was little contamination between the tests of Depiction (Test 4) and Category (Test 5). Therefore, it can be concluded that these two tests were tapping different underlying processes for understanding and different mechanisms in expression and declarative skill.

Overextension was another important variable in the children's depiction and category, as can be seen when they drew a worm-like creature with bird's legs. It is as if the children overextended the new term, Mimbo, to other animals such as the bird in their test sample. In other instances of overextension, children drew a worm with wings and thus seemed to have been confused between Mimbo and the fly or the bird in their procedural knowledge of these referents.

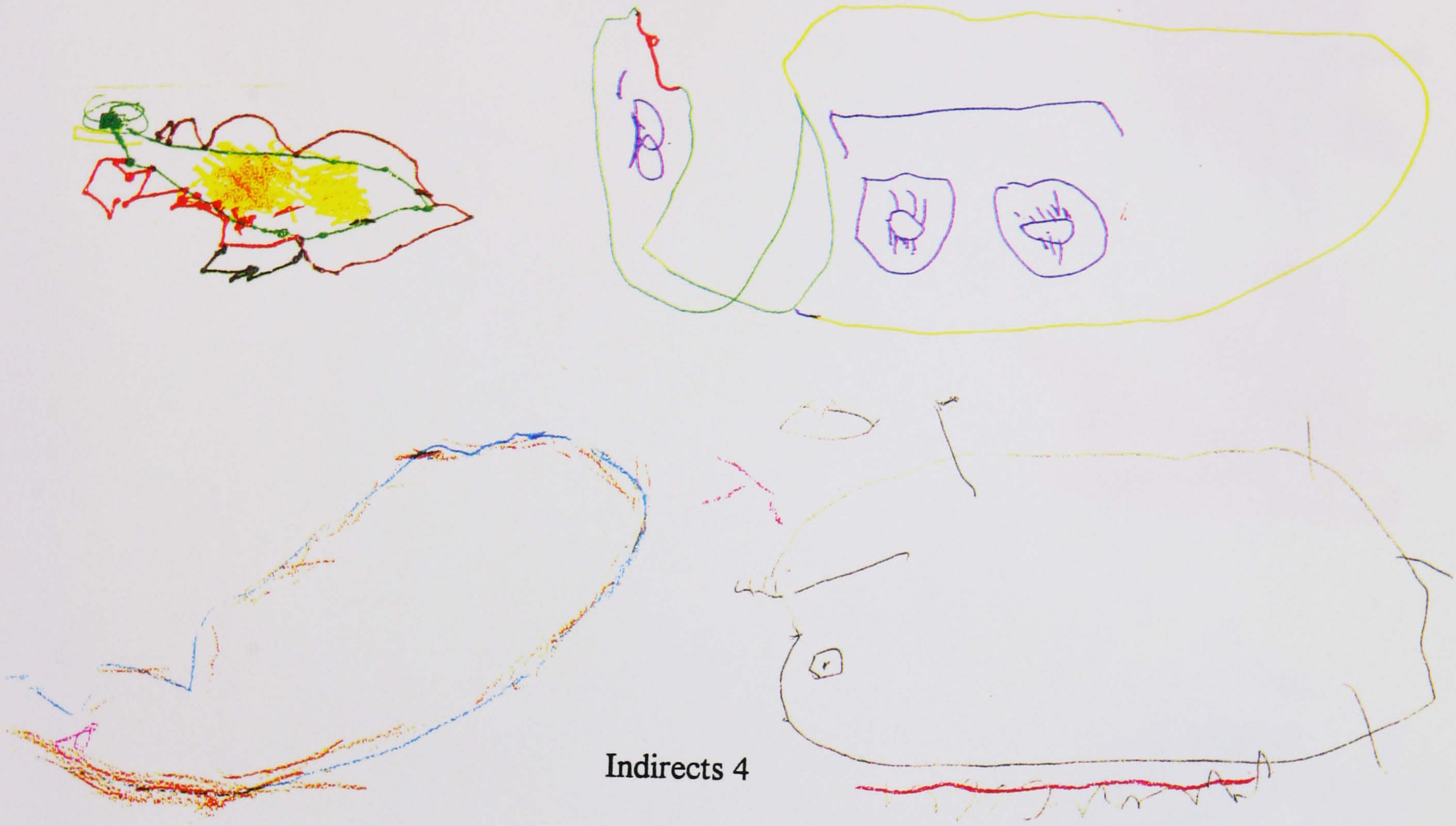
Conflicts between verbal and nonverbal levels may be revealed in Test 4 and Test 5. Children who had worked out proper decontextualisation earlier in the Encoding Phase and earlier in the Test Phase for the meaning of the new term seldom showed this pattern in the two last tests.

What I found interesting in the drawings of the younger age group was how much more content their drawings had than what is usually considered to be within the abilities of young children to draw in detail. Their drawings were symbolic and were not accurate icons of the real referent, as were the drawings of the older children. According to these productions, the younger children were clearly at the stage of caricatures or at a symbolic stage in their drawing representations (Kellogg, 1969; Lowenfeld & Brittain, 1975; Krampen, 1991). Performance styles in both age groups were highly idiosyncratic. However, a strong trend was seen in the drawings of the older children towards replicas of the test materials.

Figure 4.6. Examples of Drawings (Controls and Indirects - age 4, proper referents)

Control 4

proper



Indirects 4

proper

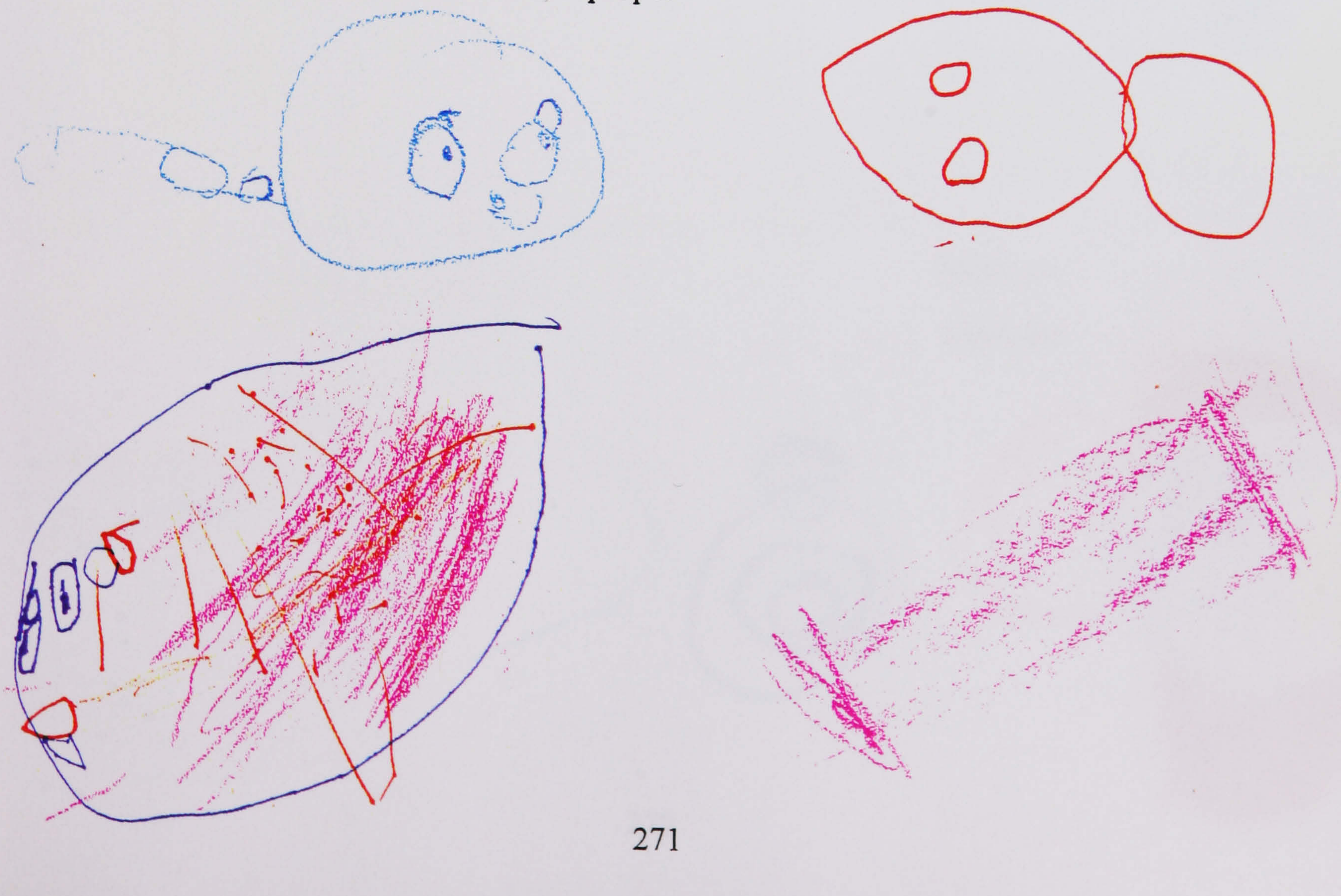
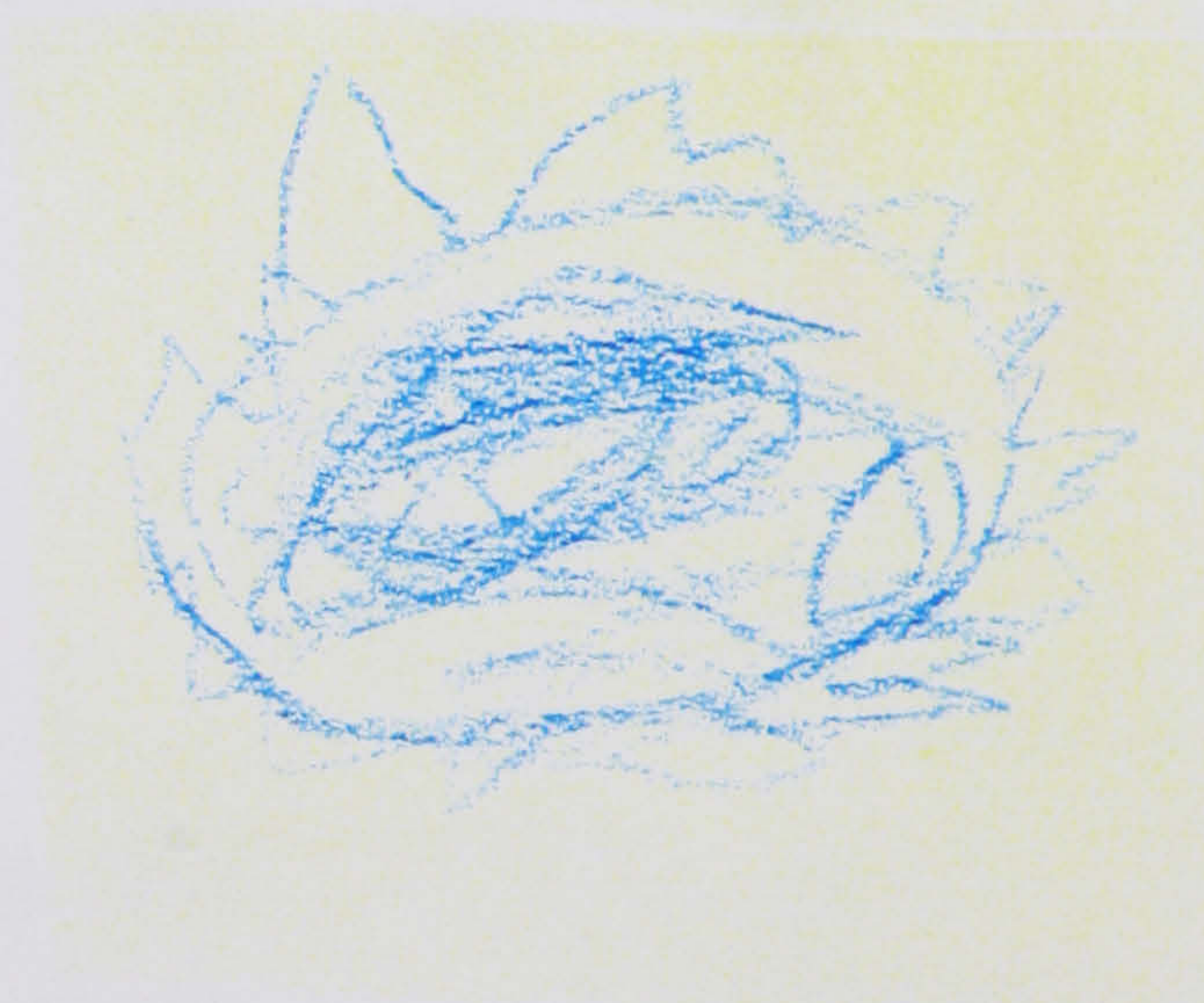
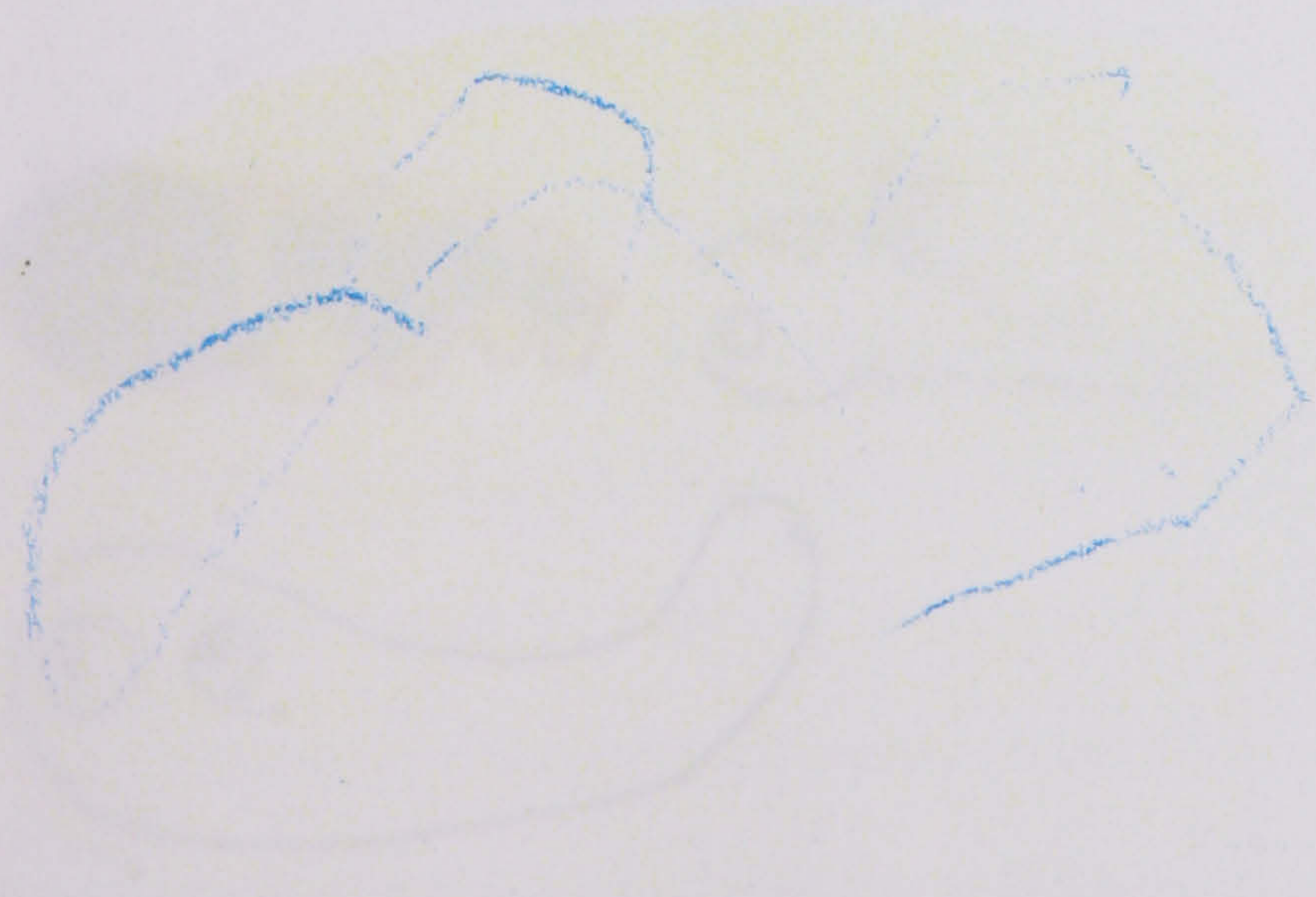


Figure 4.7. Examples of Drawings. (Controls and Indirects - age 4, improper referents)

Control 4

improper





Indirect 4

improper

Figure 4.8. Examples of Drawings. (Controls and Indirects - age 5, proper and improper referents)

Control 5

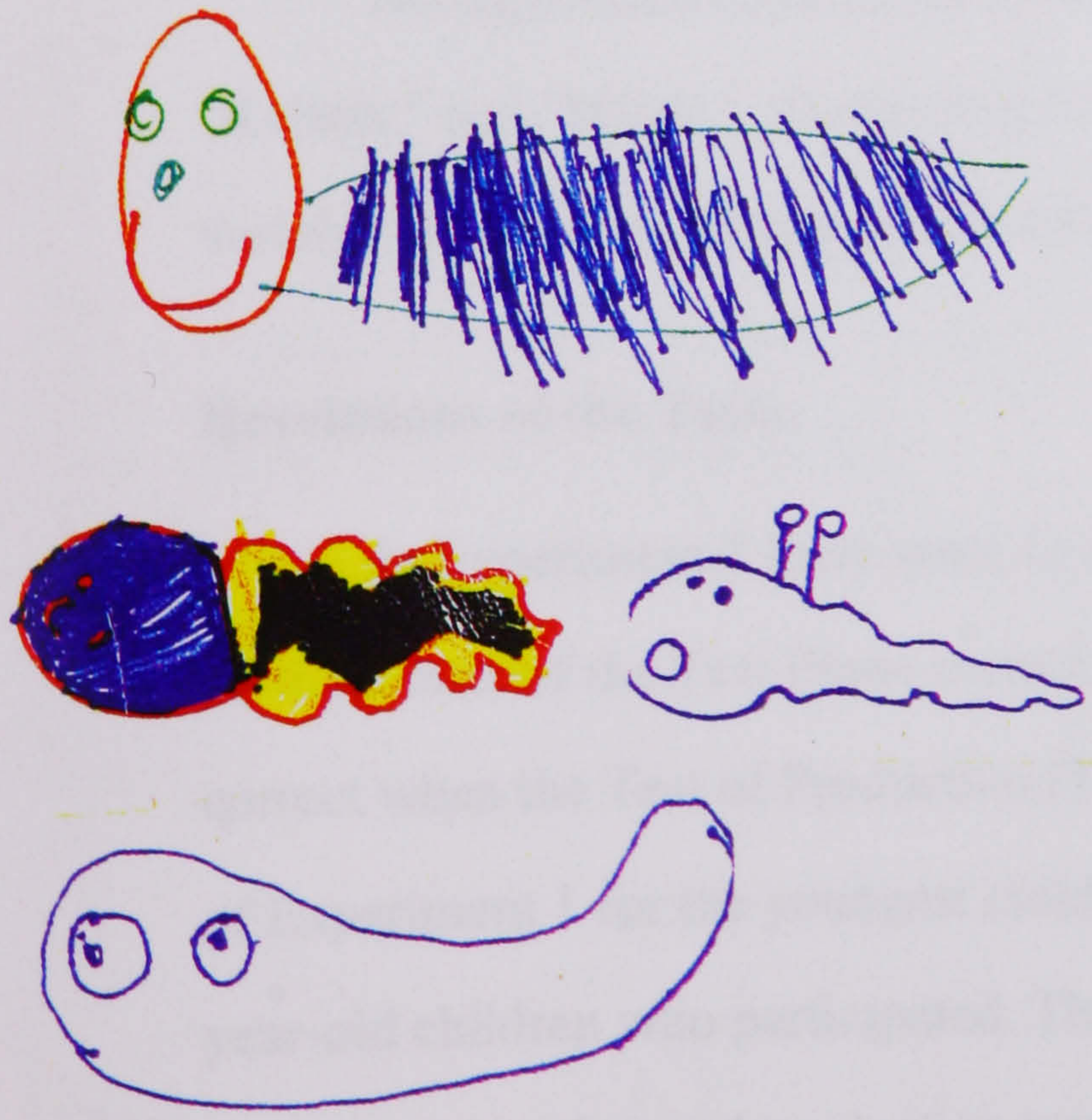
proper

Control 5

improper

Indirects 5

proper



Indirects 5

improper

Discussion.

Age, the developmental variable in Experiment 3, was not predicted to have a strong effect on performance with the 4- and 5-year-old children who participated in the experiment, since general shifts in representational abilities were not expected until an older age. Also, children at these ages, have had little school experience and training in various knowledge domains.

Subjects in a Control condition and the Indirect condition were expected to show similar trends in responding as they had in Experiment 1 and 2. Thus, Control children, who underwent a holistic encoding procedure, were expected to perform much better than the Indirect children, who had more encounters with the new referent, Mimbo, through indirect interventions in the Encoding Phase. Both these expectations were confirmed in the experiment; the younger children performed even better than the older children in some cases. However, as I have explained earlier (see p. 232-235), the encoding and the testing for the younger age group was somewhat biased. This may have provided them with learning opportunities that raised their scores. Nevertheless, among the younger children there were extremely adept children who showed correct mappings for the meaning of the new term after their first encounter with it. These children kept that mapping.

No significant differences existed between the three artificial words "Mimbo," "Kelaph," and "Mikas," all standing for the same unknown, animal creature, and used as a variable in the story. Children performed slightly better with "Mimbo."

Revelations of the Tests.

In Experiment 3 there were 11 children of the total sample of 72 children who had all the 5 tests of the Test Phase correct, and 20 children who had all the remaining 4 tests correct when the Test of Production (Test 3) had been omitted. As compared to the results of Experiment 1 for the youngest children these results are relatively good for the 4- and 5-year-old children who participated. The experiment shows a similar trend in responding to the comprehension and production tests as the two earlier experiments.

Two-Way Anova showed no significant main effects of Age and Condition for the combined score Full Meaning for all subtests in the Test Phase. Age group 5.6 performed better overall and subjects in both age groups performed better in the Control condition. As none of the two-way interactions between conditions and ages in all tests in the experiment were significant that may suggest a similarity of functioning at both age levels. One reason for not getting significant differences between the age groups may have been that in the younger age group there were extremely adept children from the playgroup of the Psychology Department of Stirling University. There were also very adept children from the morning and afternoon nursery in Dunblane who had participated in Experiment 2 and were therefore familiar with the experimenter and this type of experimental design. The children from these two places raised the mean score for the younger age group.

A strong **correlation** was found *among some of the tests:* the strongest correlation among Test 4 (Depiction) and Test 5 (Category) (.56**) and among Test 1 (Sign Comprehension) and Test 2 (Object Comprehension) (.53**). These tests clearly tap the interrelated functions of various psychological processes that are necessary for proper performance. Children who score highly overall score well in all these tests; the tests of Sign and Object Comprehension may be contaminated in the sense that they tap similar domains; however, little contamination may exist between the tests of Depiction and Category as they cover different domains, their correlation may indicate a similar ability in discerning elements however in two different domains--the one of linguistic competence, the other of graphic competence--similar to having a good logical reasoning ability, that helps, for example, in tests of some mathematical ability (but not necessarily in others), and in tests of linguistic ability.

The story was somewhat complicated for the youngest children. However, all children showed much interest in the plates and pictures presented in the Encoding Phase to the Indirects and to children of both conditions in the Test Phase and in the Posttesting. The Control children in both age groups gave slightly better responses in producing the new word, which may have been related to their slightly higher scores in comprehension. There were Indirect children in both age groups who showed confusion on two or more names in the Production Test (Test 3).

The unknown word stood for an unknown animal. Even if there were instances in which children confused the new word with a word that they already knew to represent a creature of a similar kind, there were many instances in which the children in both conditions and age groups treated the new word as standing for an unknown creature and thus showed correct mappings.

Much individual variation was found among the responses of the children within the two age groups. These differences were more significant than were the differences between the age groups. Performance styles were highly idiosyncratic, as was reflected in the children's drawings of the worm-like creature.

The drawings of the children were quite remarkable and showed more content and detail than could have been expected. The drawing test (Test 5) may have appealed to the emotive needs of the children by serving an expressive purpose and by giving the pleasure of creating a symbol world in which they could exercise more control than they had in the other tests. The drawings were clearly representations. As Thomas and Silk (1990) have said: "As a representation, we may try to understand it both as something related to natural perception, but also as a symbol which is interpreted as part of a symbol system" (p. 58).

Whether one regards the drawings of the subjects as schema, as pictorial invariants of structure, or as visual concepts, is not important. The real issue is that their sets of marks on a flat surface elicited a perceptual response that is related to, but not identical with, perception of the real world (cf. Thomas & Silk, 1990). This perception was clearly related to the stimulus materials for some children, but for others it was related to imagery based on earlier perceptual experiences and memory.

Restructuring.

Children in the experiment were aware of the demand characteristics of their situation, which was reflected in the way they treated the Mimbo, the Gombe, the bird and the mouse. They took them to be nouns that denoted physical objects that satisfied some set of perceptual criteria. There were children who realised that Mimbo designated an animal and were able to incorporate it into the proper semantic domain. However, since there were two new words, "Mimbo," and "Gombe," the children's confusion about these words could stem from: a) the children not identifying these words as proper members of semantic classes, and/or b) the conceptual organisation of the appropriate reference domains not being adequate. As Dockrell (1981) maintained: "New words which are members of semantic classes that have not been firmly defined or that are themselves ill-defined are open not only to the ambiguity of the referential situation but also the ambiguity or possibly complete lack of conceptual organisation of the appropriate reference domain" (p. 178).

According to Joos (1958), the meaning of a single term within text is restricted, "so that it means LESS IN EXTENSION, as philosophers say, and means MORE IN INTENSION" (p. 67). Thus, the connotations of words are vague in processing. When they listened to the story, the children may easily have gained the general sense that Mimbo looked like some worm-creature, but the interferences may have hindered them from specifying this any further, and the needed restructuring did not take place. On the other hand, after having worked with the test materials a few times, the children could learn that they were always being asked about Mimbo, the mouse, Gombe, and the bird. Since they were more likely to be familiar with both the mouse and the bird, they were left to choose between Mimbo and Gombe. If this were the case and they chose Gombe over Mimbo, it could have been a semantic mistake, rather than a conceptual one; they may have confused the words rather than the concepts.

Certain non-linguistic intellectual capacities are necessary before any word learning takes place. In order to identify the intended referent of a word from nonverbal cues and to construct retainable representation of it via interferences, the word, and the association between the interferences and the word, the child must have enough attention, memory, social, and auditory skills. Undifferentiated procedural patterns of the young children may be a factor in their underattribution of features and properties attributed to the new referent.

Inadequate knowledge about animals in general may account for some error responses, but as the children's conceptualisation of animals became more differentiated with gains in knowledge, there was the possibility of better-structured domains for each of the test referents and greater declarative skill. Although the animal properties were not completely undifferentiated from each other in the responses of some children, increasing differentiation could be seen as a function of age and/or knowledge.

One reason for improper mappings was that the children may have taken the task to be a task of dealing with synonyms. They may have felt that they had a name for both Mimbo and Gombe and for the bird and the mouse. The Mimbo and Gombe materials probably did not look strange enough to the children in order for them to require a new name. With more strange-looking materials than the ones employed, the problem of synonyms could be better circumvented in new designs.

There was some strain placed on these children by the procedure of asking them direct metalinguistic questions, such as those in Test 5 (Category): "Can you now tell me what a Mimbo is?" When they were asked what the Mimbo looked like, many fared better. Both Experiment 1 and Experiment 2 had shown that children had difficulties answering such direct questions, even those that referred to words that they already knew.

As had been the case in the two earlier experiments, there was a noted difference between comprehension and production, which does suggest different channelling modes. However, in the drawing test there were children who produced the new word spontaneously when the experimenter was not asking about it. These young ones were often difficult to test and often the experimenter had to simplify the questions.

Johnson-Laird and Wason (1977) have spoken of concepts as being the "coinage of thought". It has been argued that biological categories such as animal and plants are intrinsically well-defined. On the other hand, categories of objects created by humans (individual concepts) may be intrinsically fuzzy. Knowledge clearly plays a role in affecting which type of fuzzy representation is employed. Children may represent their knowledge about a set of items in terms of a fuzzy concept, whereas adults may employ well-structured feature lists. Conceptual categories such as "animal" or "car" are mentally represented in terms of the features that characterise these categories according to traditional feature analysis. Now, new important evidence seems to demonstrate that the specification of concepts by hard-and-fast rules is questionable; instead they could be specified by rules of thumb, by some sort of heuristics. The way people represent conceptual categories is affected by what they know (cf. Carey, 1985) in a given knowledge domain. As concerns the development of biological concepts in children, their conception is likely to be much fuzzier than is the clear-cut, well-defined representation of an expert's list for the same concepts.

Children are known to learn animal names early (Dockrell, 1981). Some full mappings were noticed and in other cases even if not having worked out the proper denotata, children's test responses indicated that they were working out the denotational boundaries for the new term, well on their way to completion. Whether pre-emption was at work influencing the child's ensuing mappings was questionable. These children tended to say: "Like a snail," "Like a worm," "Like a caterpillar," for Mimbo, but that may not be evidence for pre-emption; rather, the child may have chosen a familiar name because of the security it gave. Hearing the word six times in different sentential contexts clearly was a factor in proper mappings, as compared, for example, to scores for young children in Experiment 2, in which they had heard the new word in only three different sentential contexts.

There were children who were trapped by compounding real-world knowledge with semantic knowledge and there were children who appeared to be constructing a store of knowledge relevant to Mimbo. They had explicitly and implicitly been told that the key items were things in nature and they seemed to be sensitive to these cues.

Children in the study, especially the younger ones, adopted the strategy of saying that Mimbo looked like: "A worm," " a caterpillar," or "a slug," rather than answering directly: "It's an animal." By doing so, they seemed to prefer to categorise the new term at the same level as worms and slugs, instead of in terms of a superordinate "animal." Thus, they avoided shifting between levels in a taxonomy. Even when they were given choices, there were many children who paused. Then there were others who said: "Mimbo is a worm," and when asked what a worm was, they just said: "Worm." There were children who said: "Mimbo is Mimbo" which was similar to concrete, unanalysed definitions for young children in Experiment 1 when they said: "Mika is Mika," or for young children in Experiment 2 when they said: "Keila is Keila" and were not willing to specify any further.

Those children who had mapped Mimbo early in the whole procedure were more likely to define it with the superordinate "animal," and this was in line with results from standard vocabulary tests such as those of Reynell (1976). Children who score high on vocabulary items tend to score high on conceptual superordinates.

In the two earlier experiments for a similar test, Category, the children were required to demonstrate knowledge of the superordinate term in order to attain a correct score, by saying, for example, "Kelaph is a plant," or "Mikas is metal." If they said: "It looks like a daffodil," or "It looks like silver," they were also required to say that a daffodil is a plant or that silver is a metal and to say that Kelaph and Mikas were the same as plants and metals, respectively.

In the present experiment, the scoring for Test 5, Category, was not strict, as it was based on three types of response patterns: a) direct definitions (the children stated that "Mimbo is an animal,") b) choices given by the experimenter: "Is a Mimbo an animal, a plant, a bird, or a stone?" or c) what the child said Mimbo looked like: "Looks like a worm," "Is a worm."

Although the same child might say: "slug," "worm," "caterpillar," when asked about Mimbo in the Test Phase and in the Posttesting but never say: "animal," I am sure, nevertheless, that children of 4- to 5-years would have the word "animal" in their vocabularies.

A different picture might have emerged if I had asked about the concept of "animal," or the concept "alive" as Carey did (1985). But I was observing how the meaning of the word "Mimbo" evolved and how the underlying concept was related to the child's concepts of other animals that s/he knew. In a natural situation, if a child is exposed to a sample of all known animals except one and spontaneously asks about the one, s/he doesn't know, s/he will likely ask: "What sort of animal is this?" or "What animal is this?" rather than "What is this?"

I tested this notion with a boy of 4.9 years who was playing with clay animals. In the sample there was a hen, a fox, a crocodile, a sheep, a donkey, a dog, and a llama (see Photo 4.5., p. 283, for a photo of the animals). He knew all the names except the one of the llama and asked: "What animal is this?" and was told that it was a llama. Shortly afterwards, when playing with the animals, he said: "This is a llama" spontaneously, as he showed me the llama.

It is possible that the children in Experiment 3 compared Mimbo to their prototype of worms and therefore defined it at the same level. In a natural circumstance, they might ask: "What sort of worm is this?" for Mimbo rather than : "What sort of animal is this?" In the case of the llama, a different picture emerged, because there the child had many very different animals in the sample and the llama was not like any of them; the contrast between the animals was strong. The llama was different enough from the others to require a new category; whereas, in the experiment, the worm-like creature was not strange-looking enough for the children even to require a new name. The children could keep their "worm" or "slug" name without having problems in their processing of the meaning of the story or the setup of the tests. The new term may have been preempted, and, if so, the children may have had difficulty in accepting synonyms.

Even if the worm-like creature looked somewhat exaggerated, it did not require a special name; the name was therefore redundant for the children. The children may have known, from earlier experiences with stories of this type, that the story figures tend to be exaggerated and take that exaggeration for granted. Therefore, a blue worm is not strange in such a story context.

Carey (1985) has argued that even a young child may have deductive abilities to categorise new referents but not know <u>how</u> to use these consciously, or <u>when</u>. I agree with her analysis, on basis of the performance of the children when they were asked to define Mimbo.

I think that the responses of the children when they said "like a slug" or "like a worm," indicate that they based those definitions or descriptions on memory for instances of the new term and on their memories of other similar referents. They were not aware of working out the general rule for an animal concept. This happened in both Experiment 1, when the young children said: "It looks like silver," "It is silver," or "Mika is Mika," or in Experiment 2, when they said, "Kelaph looks like a daffodil." They based these descriptions on particular instances that seemed to be natural for them and they did not give much thought to the process. They relied, in their attempts when asked to give definitions, on inductive abilities rather than deductive categorisations.

Photo 4.5. Sample Set of Clay Animals (Sheep, Dog, Fox, Donkey, Hen, Llama, Crocodile)

The Need for Interaction.

Many of the young children in the experiment showed great enthusiasm, but were often difficult to test because their attention wandered somewhat. They often had to tell the experimenter about themselves, their families, and other matters of interest. It was clear in their data that a variety of coding schemes or strategies in focusing their attention on the target word in the Test Phase was used. Thus, <u>a communicative need</u> was a strong variable in their performance.

Factors such as auditory skills, general IQ, and linguistic abilities were being incidentally tested in the study. The adaptive abilities of the children were required when they realised that they had to rely on themselves, that they were not going to get help from the experimenter. This lack of feedback may have inhibited their true capabilities as young word learners. Therefore the results should be looked at in the light of all these demands.

When children are confronted with demanding academic tasks as they were in the experiment, their private speech has been found to increase (Berk, 1986; Bivens & Berk, 1990). Their need for scaffolding is also known to increase in such situations. Vygotsky (1962) had maintained that private speech helps children to integrate language and thought. He had argued that what begins as personal speech gradually becomes, as the children grow older, internal thought. The type of personal speech that children most often use is "self-guiding," taking on a guiding function in the form of self-answered questions. When young children are working on complex tasks, they are known to comment, for example, as follows: "Because this is where the spots are supposed to be," or to use self-guiding comments such as: "Don't put this red colour there on the head."

The behaviour of the young children in Experiment 3 showed the need for expressive circumstances for such young children. The type of experimental setup was inhibiting since it did not provide any "scaffolding" between child and adult. (There was a lack of paraphrase of what the child said, which runs counter to the usual pattern of conversation between adults and young children). When children are told stories, they are often used to scaffolding; an adult or an older child "scaffolds" their retelling of the story, in order to help them achieve declarative understanding, which, although almost entirely dependent on their prior knowledge, they might not otherwise have achieved (Bruner, 1966; Light & Butterworth, 1992). This lack of scaffolding and retelling in the present study possibly decreased the confidence of the children and their fluency in demonstrating their knowledge. Thus, the conative or affective needs of the children, needs that Werner (1948, 1950, 1954) has argued are important for language acquisition, are suppressed in this type of study, together with their cognitive needs.

The children relied on guidance and direction from the experimenter before they could function independently. In a natural circumstance, when an adult provides assistance necessary to carry out a new task, children can structure their efforts in the same way as the adult, and thereby create a framework within which to guide their efforts, at times with the assistance of private speech.

It was natural for the 4- to 5-year-old children under study to be verbally active while solving problems and completing tasks. By being attentive to the private speech of the children, the experimenter could have asked them the same kinds of questions that they were asking in their private speech, in order to help them solve their problem. However, according to the experimental paradigm, such interference was not allowed. It is known that this type of help is needed in ordinary circumstances when the children receive guidance on tasks that are at the edge of their abilities and experience and are co-ordinated with their current level of development. Griffiths (1986) has argued for an interactional theory of language acquisition, and contends that the child is not engaged in "...a lonely task of acquiring a stock of meaningful adult expressions. Rather, the child and adult are building a communication system by making their understanding known to their partners" (p. 290).

Conclusions.

What I am arguing is that speech, which Joos (1952, 1958) has defined as communication, is a variable entering language acquisition. The lack of emphasis on the speech of the children in Experiment 3, and the lack of an affective tie with an adult communicator was a lamentable factor for many children. Therefore, the type of setup employed, together with the faults of the design and the biases of the administration of Test 1 and 2 may not have given a proper reflection of a young word learner's ability to decipher language.

Nevertheless, Experiment 3 provided support for the basic implications of Experiment 1 and 2--namely that even with younger children, rich and complex knowledge of linguistic material can be obtained in the Control condition independently of overt, conscious strategies for acquisition. These children, even if not having the learning opportunities of the Indirect children, still processed information from the linguistic material that helped them encode the meaning of the new term.

The shortcomings of the experimental setting that was employed with the two age groups showed that there is a need to create situations in which children feel free to express themselves. The experiment also showed the need to use a shorter story. Generally speaking, there is a need to create a less strenuous practice for the children. The results showed that interferences provided learning opportunities for many children, so that they could map the word properly when they were provided with the test sample of referents. I would argue that in a natural circumstance, a repetition of the story would have provided enough support for proper mappings of the new term without the use of any test materials, or objects. It would be interesting, in a new experimental design, to run a somewhat shorter story twice with a Control group, without any interfering questions on the theme of the story, then to compare the learning products of the Controls with the learning products of an Indirect group that had interfering questions on test materials.

In a new design, a different methodology, such as that of Experiment 1, in which I worked with more unknown materials and names for young children, would, perhaps, provide greater control over the linguistic and non-linguistic attribution towards the meaning of the new term, and from which Control children might benefit more than

Indirects would. However, I would expect children in both these conditions to come up with similar learning products, quantitatively speaking, because of their self-regulatory adaptations, taking place within the children, no matter which of the two conditions as it is clear that many children realised the nature of the task and that realisation is, perhaps, the important factor in proper deciphering (cf. Light & Butterworth, 1992, p. 16-18). Indeed, it was difficult to provide thorough incidental/intentional dichotomies in the two conditions that were employed. I strongly argue that a demand on explicitness in the Metalinguistic condition in the two earlier studies would be beyond the capacities of these young children and would mislead them and interfere with the needed restructuring.

In natural circumstance, I would recommend "rich language" in order for verbal creativity and verbal intelligence to develop in the growing child. I argue that the growth of the creative skill behind language depends on the growth of imagination and the mental image. Pretence play in which words rather than objects are used, is a source of vocabulary growth in children. The depth of the understanding that children have and the intension of their underlying concepts or connotations is dependent upon a highly desirable skill for literacy and the growth of vocabulary. Bivens and Berk (1990) have contended that the language environment of children should be provided with elaborate and complex sentences as well as simple ones. By hearing text that is somewhat complex, the children get a chance to practice their linguistic skills when deciphering. They need to receive many and varied meaningful experiences in order to have a background from which to express themselves. This experience also gives them encouragement and support, which is necessary for their use of language.

Bivens and Berk (1990) have argued for the functional significance of private speech. Accordingly, the early social speech of the child is global and multifunctional and gradually separates into two functionally specific types: speech used to communicate with others and speech directed at communicating with the self; as private speech branches off social speech it becomes thought that is spoken out loud--an externalised self-monitoring system that plans, directs, and controls behaviour. When the child successfully brings action under the control of her/his self-directed verbalisations, overt private speech diminishes and turns into inner speech or verbal thought:

> ...cross-sectional studies of the private speech of preschool and early elementary school children indicate that it follows an orderly developmental path, proceeding from task-irrelevant self-stimulating forms (e.g., word play and affect expression) to task-relevant externalised speech, and finally to the more internalised forms of muttering and lip tongue movement (1990, p. 444).

In concluding, it can be stated that the context embeddedness of children's thinking (Donaldson, 1978, 1992), as reflected in their drawings and in their attempts to categorise, was an established factor for children of both age groups and conditions. They clearly adhered to the practice of describing what the new referent looked like, compared to other animals they knew, instead of declaring directly what the new word meant. Such declarative practice seemed to be unnatural to them. But failure to demonstrate the skill does not necessarily confirm the fact that the children were incapable of such a skill. They may have had to be taught the skill or it may have been necessary to point out to them that that was the requirement.

Many children overextended the target word to other animals such as the bird or the fly, indicating that their denotation of the term was not properly limited. The study did not give scope to estimate the precise criteria upon which each child settled for his or her mapping. Even if denotation had been mastered in some full mappings of the new term, as reflected in the test responses and in the restructuring between the Test Phase and the Posttesting, the extent to which it had been mastered can only be established in the context of use for the child which the present study does not give the longitudinal scope for (John Dewey, 1910).

CHAPTER 5
SUMMARY

In this final chapter I discuss the results of the present experiments and the consequences of the probing techniques and what these tell about word use as compared to word meaning; also, I speak of the importance of the social dimension within which the child is functioning, and, lastly, of the applications of the results.

Since many factors are operating concurrently the child when acquiring or understanding a word is required to synthesise meanings derived simultaneously from many sources (Crystal, 1971, 1987). But the child seems to carry out this "vastly complex task" with great ease. John Lyons (1977a) has argued that a great deal of language is learned initially in an intuitive manner. He speculates on the topic of language acquisition as follows:

> The child learns the applicability of words, expressions and utterances in all sorts of situations of language use and his initial assumptions about the sense and denotation of the words he hears in utterances may be guided by more or less specific innate principles of categorization (p. 228).

Similarly, Johnson-Laird (1985) has argued that "Indeed, you can never be completely conscious of how you exercise any mental skill" (p. 465). The division between conscious and unconscious processes is, he contends, the best available cue to the structure of the mind. In the work presented in this thesis, I have not attempted to define operationally the variables "conscious" "unconscious," but feel sure, on basis of the general results, that reflecting back on language in a logical focused awareness is not the natural way for children to gain understanding of the meaning of new words, and that both "conscious and unaware knowledge" interlock in the deciphering of word meaning (cf. Joos, 1972).

An important part of the studies is the noted tendency by the children to work eagerly on the tasks, and it leaves me to wonder if solving these tasks is motivated by their goals to learn new words or as Bruner has stressed "we come to love words." Bruner (1964), for example, spoke of general regulatory mechanisms and self-regulatory abilities in children and argued for a "principal creative ability," relating it to the adjustment of needs and the function of the behaving child. Certainly, *passion* and *emotive needs* are some of the strong factors that account for the rapid learning that was seen to take place in the three experiments with children of 4 to 12 years. I am not, however, by stressing passion and needs, arguing for a conscious voluntary and purposive activity--the dilemma of consciousness is not solved here--but pointing out that consciousness is an issue entering language acquisition in children, and that the regulation and the restructuring that takes place in the growth of word meaning can be, on the one hand, based on "self-regulating" activity or systems, mechanisms which processing is not conscious, and, on the other hand, on processing that depends on the growth of personal awareness, the perception of the self in the world, and on self-regulating metarepresentations.

5.1. Results.

The children in the studies were bombarded with many types of input and were required to synthesise information from various sources. According to Campbell (1979), we need to know much more about the structure of children's message representations and the rational processes available to them. He thinks that a dual representation might account for this synthesis; every structure might be presented differently at different levels. Causal criterion is, perhaps, represented *phenically*, but the heuristic identification procedure may be *cryptic*.

In the three experiments, the children's "developing theories of the world" (cf. Carey, 1985) and their growing knowledge structure had much to do with the growth of the new natural kind term, the development of their rational processes as Campbell (above) suggests. The children were seen to make use of various information from both linguistic and non-linguistic contexts.

Miller and Gildea (1987), in their experiment with American schoolchildren, in which they were estimating how the children learnt new names from sentential contexts, have argued that the word process becomes more complex over the school years, as children learn to read and write. Children, they argued, are quick to notice new words and to assign them to broad semantic categories, to the proper semantic field; thus, as suggested by Campbell (above) their heuristic identification takes place rapidly. They are able to keep such fields separate even before they know what the individual words mean. Asked the colour of something, they may respond with any colour they know, at random, but they never answer with the words "round" or "five" or "lunch." However, a slower stage follows, one that entails working out the distinctions among words within a semantic category. A child who has correctly assigned red, green, yellow, and blue to the semantic field of colour terms still has to learn the differences between and the relations among those words. This stage takes much longer than the first and rapid stage and may never be completely finished; some adults correctly assign delphinium and calceolaria to the semantic field of flowering plant names but have not learned what plants the words denote and cannot identify the flowers on sight: "At any time many words will be in this intermediate state in which they are known and categorised but still not distinguished from one another," (p. 87).

The tests in the three experiments were designed as assessment tools of the growth of word meaning in children. The tests were not intended to be "intelligence tests;" rather they were concerned with a range of functions. The total testing profile of each experiment included: a) language ability assessment, both comprehension and expression, b) verbal and imaginal coding, and c) general knowledge and IQ. The different tests reveal interesting individual variations in the sample and different testing profiles. The tests show much correlation among them, especially tests that were designed to test for verbal coding, comprehension, and general knowledge, and verbal tests correlate with tests of imaginal coding--high scores on verbal tests usually relate to good performance in the depicting tests--and tests that were designed for the production of the new term correlate with tests of comprehension and highly with tests that only test for categorisation, conceptual understanding and declarative skill based on the understanding of logical relationships between words in a taxonomy. These test results may indicate that the tests of production and of linguistic definitions better reflect true linguistic abilities than tests of comprehension, general knowledge, and imaginal coding which may be broader and cover a wider range of both linguistic and non-linguistic functions (see Ch.2, p. 79-80 and p. 119-120, Ch.3, p. 166-167 and p. 197-198, and Ch.4, p. 242-243 and p. 274-275 on the correlation among the tests). Thus, tests of production and of definition may be better screening tests for linguistic abilities. In concluding with the value of the tests, I can state that the criteria of sense, reference, and denotation proved to be useful to tease apart each aspect of the word's meaning by working these out in different tests in the test batteries.

Basically, it can be stated that the tests in Experiment 1 and the experimental setup resulted in the highest scores for the 3 experiments: in Experiment 1 there were 76 children of the total sample of 160 children who had all the 5 tests of the Test Phase correct, and 123 children had all the remaining 4 tests correct when the Test of Production (Test 4) that proved the hardest had been omitted; in Experiment 2 there were 32 children of the total sample of 192 children who had all the 6 tests of the Test Phase correct, and 63 children had all the remaining 5 tests correct when the Test of Production (Test 3) had been omitted, and, finally, in Experiment 3 there were 11 children of the total sample of 72 children who had all the 5 tests of the Test Phase correct, and 20 children who had all the remaining 4 tests correct when the Test of Production (Test 3) had been omitted. Thus, the testing in the three experiments shows a striking difference between word meaning and word use in all age groups, that, again, may be a result of the probing techniques as the experimental designs gave more scope for the child's exposure to contexts including the new term and for his/her practise of the comprehension of the new term than for the practise of its production: in the Test Phase there were several more tests of Comprehension--both verbal and nonverbal--in each experiment than there were of Production, and, besides, the Encoding Phase mainly focused on Comprehension.

Statistically, the results can be presented as follows:

In Experiment 1, a Two-Way Anova showed significant main effects of Condition, $\underline{F}(3,144) = 3,43$, $\underline{p} < .05$ and of Age, $\underline{F}(3.144) = 48.06$, $\underline{p} < .001$ for the combined score Full Meaning from all subtests in the Test Phase. Age group 11.6 performed best overall, particularly in the Metalinguistic and Indirect Conditions. However, age group 9.6 in the Indirect Condition performed better than did subjects in any other age group or condition.

In Experiment 2, Two-Way Anova showed main effects of Age, $\underline{F}(3.180) = 4.39$, $\underline{p} = .005$ and of Condition, $\underline{F}(2.180) = 3.25$, $\underline{p} < .05$ for the combined score Full Meaning from all subtests in the Test Phase. Age group 10.6 performed best overall and subjects in the Control condition gave better performance than did subjects in any other age group.

In Experiment 3, Two-Way Anova showed no significant main effects of Age and Condition for the combined score Full Meaning for all subtests in the Test Phase. Age group 5.6 performed better overall and subjects in both age groups performed better in the Control condition.

On basis of above, I would argue that the experiments have been so designed that they tested the competence that one wished to investigate in the Control condition. They all showed a similar trend: the Controls performed well and not worse than children in the Intervening Conditions and even better at times; the differences were seldom, however, statistically significant. This result is in line with earlier experiments with adults on the effects of encoding on performance, such as the experiments of Aveling (1911, 1912), and of Brooks (1978) in which there was not a significant statistical difference between the different conditions but a difference in the quality of the learning products.

By using large samples, I have, if the rationale is correct, gained a proper distribution of what could be expected in the wider population. It should be pointed out, however, that the children in the three studies came from areas in mid-Scotland with high living standards and parental education.

Children in the oldest age groups in Experiment 1 and Experiment 2 were known to score above average on a standard vocabulary test of English that is administered yearly in Scotland to Primary 7 children before they enter high school. Also, the areas from which the children came have a high socio-economic status. Therefore, the type of sample that I employed may account for the high scores that subjects in the experiments attained. However, I would expect that the general testing profile would be similar but that the scores would be lower with a sample of children of lower socio-economic backgrounds related to a difference in ability associated with the different populations, patterns and rate of development of verbal skills may be different between the sample employed in this study and children in other parts of Scotland. These tests work well with gifted or highly talented children but may not work as well with a different sample. Also, because some of the same children participated in Experiment 1 and Experiment 2, and because a few children participated in all the three experiments, there were children who were quite experienced with the experimental design.

Furthermore, many of these children have parents with high socio-economic status and education and have very likely gained superior skills through their family interactions, picking up invariants of the structured linguistic context. Thus, I argue for an interaction between ability and social variables; however, the results of the "high-scorers" in the studies may have to be looked at independently of their social background and the type of encoding that they underwent. Improved experimental designs that are more developmentally age-sensitive than the ones employed in the studies--the results show much individual variation--are needed in future experiments.

It is clear from the Miller and Gildea (1987) experiment that children need time to learn to distinguish nuances, and should not be asked to use the new words in sentences until this distinguishing has taken place. Miller and Gildea also stress the importance of motivating children to learn about the subject matter and of exposing them to new words within that context, reading to them over time in several sentential contexts, then testing them for recognition. As with the Control children in my own experiments, these researchers were aware of the difficulty that children may have in giving direct definitions when they are being tested for recognition or when they are making the needed bridging inferences between the information they already have and the exposures of the objects to which these new terms refer.

Children are always coping with interferences and complex stimuli when processing language in real life, and, must, therefore, need flexible contextual abilities and creative insight thinking for the processing (see Ch.1, p. 3-8 and Ch.5, p. 306-307 on Joos). The results of my experiments could be looked at in the light of the flexiblity of such contextual abilities and of insight thinking, no matter which type of interference was employed. An important finding was that the children did not stick to their error as much as predicted; instead they tried options. Rarely did a child score "0" throughout the studies. Rather than always repeating the same mistake, most children fluctuated between guesses, so that they attained some correct scores on some tests and some suddenly came to the proper solution that stayed with them. What emerged in the studies was the need of the younger children for more expressive circumstances in which the cursive act of thinking was brought forth: as in pretence play, in private speech, speech to oneself, in the form of self-cueing and self-guiding comments (Berk 1986; Bivens & Berk 1990).

There was greater variation in knowledge among older children, but they were similar in thinking. If there were no differences among the groups one might ask if linguistic abilities create the variation. As stated above, the results of the different conditions often showed homogeneity of scores and learning but the quality of the learning from condition to condition was different. The differences between the conditions in many learning products were small. Rather, there were differences in emphasis such as the drawings of other things than the sample materials among Controls. There were more stimuli-bound drawings among Indirects. In the Control condition, there the questions asked by the experiment always made inferences about the theme of the story. It is not, therefore, known whether the scores for Controls would have been higher if the children had processed the story with no such interferences and had then only been asked about the meaning of the new word after the whole story was finished. I would suggest such a procedure for further experimentation with Control children.

With the results, one can ask if there were differences between the three natural kind terms. For example, was the animal name easier to learn than the metal or the plant name? The children were apt to guess that an unknown word such as "Mikas" referred to an unknown material, so that successful reference was established. Some children in all groups progressed from knowledge of reference to knowledge of denotation of the word, such as knowing the denotation of other similar metal names. The hierarchical network of the lexicon seemed to have evolved, even in the youngest children, to the stage that they were sensitive of the syntactic categorisation of the unknown term, that it was a natural kind concept. This hierarchical arrangement furnishes the mind with a multitude of associations or retrieval cues. If the children had gained sensitivity for the internal hierarchical structure of language relations to other words in the same semantic field, this retrieval probably started at a high level of abstraction and worked down to a more specialised level; if the initial reference was wrong, the children had difficulties recovering from blurred information.

The children had repeated encounters with the new word in the different linguistic contexts. Their developing memory skills were well reflected in their gain in performance with age. The older children clearly demonstrated effects of schooling on memory skills. All the age groups showed a considerable power of recognition. Recall came later, it seems, as was reflected in the production of the new word and may have accounted for some of the differences between comprehension and production. The younger children used more reasoning of a primitive scientific sort, whereas the older children used considerably more sophisticated reasoning; they could alter or reconstruct their designs. However, what went against this ability was often their own self-caution and attempts at "logical" thinking.

Thus, it is clear from these data, generally, that *the development of the new term* increased as *a function of Age*. The youngest children could not always deal with the structure of the whole experimental set up and that biased their results relative to the results of the older children. Donaldson (1978) has warned that such an artificial setup might go against the natural skills that young children have for processing language.

Finally, these results provide support for Joos's idea (1948, 1959, 1962) that early interference with the meaning of a new word when deciphering from a verbal context results in errors. However, recovery was possible for many children, if not guaranteed.

5.2. Consequences of the Probing Techniques.

In the Experimental conditions, the manner of the input clearly affected the children's decoding of the new concept. However, children with very well-structured conceptual knowledge and good vocabulary seemed to overcome the ambiguities of the Experimental conditions and Age was not an important variable in their performances.

The cognitive needs that children have when they must structure their newly acquired information and experience, together with an emotive need that motivates them to learn the meaning of an unknown word, were well expressed in the behaviours of all the age groups and within all conditions. This was in line with Werner's (1948, 1950, 1954) arguments. He had argued that the primitive concept is not a specific and a stable one, but relative and shifting and shows a lack of proper polarity between the child's self and the world. He further argued that abstract concepts result from the sharpening of the polarity between the child's self and the world. These abstract concepts tend toward high stability and specificity and are expressed in a mature understanding and more sharply determined relations and logical deductions.

When processing the new information, the children often seemed to rely upon a principle of cognitive relevance in the input. They picked up what was relevant in order to make a sensible whole rather than looking for pragmatic relevance in communication with the experimenter, who gave no feedback or support for their newly acquired notions. Therefore, many children learned early in the experimental process that they could not rely on information from the experimenter. Strategies in their decision making were clearly affected by the setup of the experiment and their use of conceptual knowledge.

The Indirect Condition.

The experimental setups in Experiment 1 and 2 appeared to be more appropriate for the older children, but beyond the competence of the youngest children. Presence of non-linguistic context was a significant variable in the performance of children in the Indirect conditions. The simultaneous processing of all the different aspects of the new word's meaning was, however, too much for many children, regardless of condition.

The experiments gave much insight into the designing of different stimuli materials, and how they adjusted to the requirements for unfamiliarity. It became clear in Experiment 3, for example, that none of the materials was as strange looking as they should have been. There were not enough features on the blue plates that were employed; there was a lack of contrast. The pictures in the experiment had more features and more contrasts and there were contrasts in the colours in the pictures. Similar to Experiment 2, because of the nature of the linguistic contrasts provided in the story and the perceptual contrasts, many children may have interpreted the new terms as synonyms. In Experiment 3, the importance of features was well reflected in the drawings; the children tended to draw big eyes on the worm-like creature. The concept of flowerness, or animalness clearly played a part. In Experiment 2, since there were four different variations of each symbol type, these symbols provided more perspectives than did the blue, plastic plates in Experiment 3. It is possible also that the children did find complex patterns more interesting than the simple ones and were thus more motivated by the more complex materials in these two experiments. With linguistic and perceptual contrasts lacking in the two later experiments, some children may have taken the new words for synonyms for known words, so that with some children the problem of deductions did not arise. Children are known to be able to use superordinate names in other instances, such as in the llama experiment in which the contrasts were sharply circumscribed in the sample. According to Carey (1985), worms do not come as close to animalness, or to the prototype animal, as do many of the other animals such as dogs or tigers that she employed in her study.

When met with contrastive information in a restricted referential situation, such as in the Indirect condition, the children's knowledge of the referents in the test sample clearly helped them to create the denotational boundaries for the new word. If their knowledge of two or more other referents was inadequate and if they were not leaning on the available linguistic information, this lack of clear structure in their situation created conflict for them. Taken as a whole, however, these data show strong evidence for the ability of the young word learner to map the new word to the proper semantic domain by using cues from: a) the linguistic information in the story, and b) the set frame of the stimuli sample. When the children were asked to hand over this or that object from the sample they were sensitive that they were being asked about substances, plants, or animals, about natural kind objects. The protocols showed sensitivity for some sort of natural kind nominals.

Sensitivity towards syntax proved to be strong from early in the experiments, sustaining the claim raised by Werner and Kaplan (1950, 1952) for a strong interdependence between grammar and meaning. The new terms, Mikas, Kelaph, and Mimbo clearly related to the children's general concepts of natural kind terms. The children spoke of features such as: "hard," "shiny," "gets dots," "heavy/light," and they attached colour to these natural kinds. Fast mappings, or short-lived alternative idiosyncratic hypotheses were common. A stronger feature, however, was the striving of the children towards the full mapping of the new term and their recovery of error. But recovery from error in the experimental conditions may have been a function of the children's general cognitive knowledge rather than a semantic acquisition.

The Metalinguistic Condition.

It was clear from the children's protocols, that their ability in the Metalinguistic conditions to integrate information from sentences about the meaning of the new word increased as a function of Age. There were gross individual differences noted in the inferential abilities of the children and different cognitive styles. However, even for the oldest Metalinguistic children, the co-ordination of information in an additive/subtractive manner was not natural to them--as when comparing their various definitions of the new word in order to estimate similarities in their definitions. The children used poorer access to that feasibility than could have been expected, even when they were given the choice. This lack of reasoning on the processed linguistic information supported Joos's idea (1972) that the meanings of words are processed instantaneously at a conceptual level and processed at tacit levels of understanding. And it also supported Denny's argument about the habits of our everyday thinking. Further, I would argue that evidence for the principle of lexical contrast or pre-emption--no two forms can mean the same thing--was established in the experiments. As their metalinguistic awareness grew with age, the children realised that two word forms could rarely mean the same thing. Thus, pre-emption was more apparent in the younger children and was reflected in their production rather than in their comprehension of the new word.

It was not possible to learn how the Metalinguistic children processed their information by simply asking them. If Joos's thesis is right, inferential skills for processing information from text do not result from automatisation through conscious experience. There was difficulty in articulating children's knowledge of these processes and even when given the option, difficulties cropped up; the children found it strange to connect information through conscious reasoning. Thus, it seems that processing semantic information involves something more than (or something qualitatively different from) systematic relations between events and features, something more than associations, a holistic sensation the Gestalt nature of which is not easily tapped by questions aimed at specifying the process of the structuring and restructuring of the perceived whole.

The demand on the children, even the older children, to be aware of the process of connecting semantic information from various sources of the linguistic context seemed often to run counter to their needed semantic reorganisation of coded information and their proper use of data bases, in order for the new concept to emerge.

The Metalinguistic children gained familiarity with the interval testing and started creating expectancies; thus, they were not filling in the inferences as encoding proceeded but were figuring out the correct answer when the questions were asked. Thus, the process of making crucial inferences during their original auditory processing of the text and storing them in memory was blurred. When the Metalinguistic children were asked explicitly to give definitions of the word being processed, an element of stress or anxiety was clearly evoked in some of the younger children. However, in other children of that same age group, a sense of motivation appeared to be evoked. For the children in the oldest two groups, conscious strategies were evoked, such as their metalinguistic and metacognitive awareness. Nevertheless, these manipulations may have engaged the explicit system and elicited anxiety that was related to the poor performance of many children in combining information. The children were required to co-ordinate the new linguistic information with the previous responses in order to infer the appropriate denotation of the term. Thus, they may have been either helped or handicapped by having to make a series of explicit responses. Their task appeared to be more a matter of problem solving than of mapping meaning onto words. Since I argue that, for example, the term "Mikas" in Experiment 1 was not preempted in the lexicon of the children, they were presented with information that could count as elaborative linkages or semantic extensions for them in learning the new word. If the new term was preempted, as may have been the case with Kelaph in Experim ent 2 and with Mimbo in Experiment 3, the children were translating or solving a problem. Thus, if the children already had a lexical entry for the natural kinds referred to, pre-emption was a variable. This hindered them in identifying the referent of the new term, similar to Clark's (1987) argument that children reject multiple labels for the same object.

The Control Condition.

Useful diagnostic pointers can be found in the pattern of scoring and the way in which the tests were conducted. For the Control condition, for example, it is important to state whether the children asked for second trials, or were offered second trials by the experimenter when they paused or were in doubt. Furthermore, the experiments reveal that bridging inferences are needed for the Control children. However, it is difficult to see how to solve that problem without violating, at the same time, the conceptual distinctions that are, according to Joos, made at tacit levels of understanding.

In the present studies, relevant responses from Indirect children were predicted to be traceable to the physical characteristics of the target materials. Their protocols were expected to be more data-driven than were those of the Control children, as was well established in the data. Relevant responses from the Control children in the Test Phase were predicted to reflect some relevant information or contextual determinants that were not traced to the physical characteristics of the target material or object. These were responses based on experience and memory, and, as such, were based more on intensional criteria than on extensional criteria and were more conceptually driven. The memories may not have been the ones to which the Control children had conscious access. If these memories were available to consciousness, the Control children may not have realised it or they may have been unable to see the importance of making the metacognitive assumption that the information was relevant to the lexical decisions required in the testing.

The Control group was not as "ostensively bound" or as affected by the stimuli materials as were the experimental groups. Therefore, their responses had more semantic content. Also, when many processes were occurring simultaneously, the motivation of the children may have been in the direction of acquiring a new word rather than solving a particular task.

It is clear that the Control children were able to acquire the abstract structure of the new term presented in the text under conditions in which the acquisition was unintentional. This knowledge can therefore be seen as having been obtained in the absence of conscious strategies used to acquire that specific knowledge. The lack of manipulation of the target word in the Control condition was shown to be maximally beneficial when it was representationally co-ordinated with the tacit knowledge derived from experience. The children's own store of knowledge actively contributed to the mapping of the meaning of the new word in the experiments. When decoding the story, the children brought their own experience to bear on what they heard, by filling gaps, by interpretation, and by deciphering from what was given in the text.

The Control situation allowed continuity and a final global assessment after a unified presentation. The children were presented with a general picture allowing implicit connection of the word and its referent. There are strong grounds to suggest, on the basis of the Control data, under which conditions the acquisition of the new term was unintentional, that the "Control learner" can be described as an implicit learner who emerged from the training session with a tacit, valid knowledge base co-ordinate with the structure of the stimulus environment.

Contextual information is sometimes described as top-down information and strong stimulus information as bottom-up information. What I would like to argue is that the children clearly made use of both bottom-up and top-down strategies in the special conditions with which each child was confronted, and that these strategies did co-ordinate, no matter which condition. Children must rely more on bottom-up processing than on top-down processing for most kinds of discourse to build an overall representation of the meaning of what is being said. Repeated experience with structural representations such as the common format of a story allows generalisations about their structure to be formed. These structural representations enable children to engage in a good deal of top-down processing in which their comprehension is guided by and partially controlled by their expectations of what is to come. What is retained is the underlying gist of the story; many details of the surface structure are lost.

I argue that the Control learner depends more on top down processing than on bottom up processing, and, that, in order for the top down processing in his/her condition to take place repetition of subject matter that gives a sense of familiarity or acquaintance is needed. There was lack of repetition in the experiments of the subject matter and that lack may have been a factor affecting performance.

There is the suggestion in my data that the bridging of inferential processes needed for the children were to some extent metarepresentative processes. Then there were variations among the children in the forming of these processes and their use. By metarepresentation, several factors are meant, such as: a) knowledge of one's other representations, b) knowledge of what other people know, and c) the ability to make inferences from these two former issues on statements in the world, or to reason counterfactually.

I have argued for the incorporation of pretence play into new designs of language research, because pretence relates to the real world in a very strict sense; there is a form of early pretending related to the verbal mastery of language that may be due to the availability of a cursive way of thinking needed for children to shift from the procedural nature of their thinking to include major declarative components. Metarepresentations at a cursive level are expressed in pretence.

Children are neither active nor static in the word-learning process; they seem to act upon themselves and to change. As they grow in their awareness of own thoughts, that awareness is, in itself, a force capable of altering those thoughts by monitoring, guiding, and correcting them. Flavell (1972, 1979, 1986; cf. Flavell & Wellman, 1977) had spoken of metaknowledge as gradually appearing in the course of the child's mental development and as one of the most distinctive features of the human intellect. Examples of this awareness in children are when they realise that a fact should be checked before taken to be true, or the feeling that it would be well to make note of something that they might forget. Flavell has defined reflective access as thinking about one's own thinking. This does not mean that one is aware of one's processing, but rather to have access to the products of some of that processing and be able to represent these processes for oneself and others.

In concluding on the consequences of the probing techniques, I must state, however, that another type of self-regulation affecting performance may have taken place in all the conditions for the children other than the self-regulating aspect of their growing metarepresentations, and that this other is some autonomic, self-regulating mechanism at tacit levels of their understanding--especially affective for automatic control in case of the Control condition: the child modifies his/her learning without being aware of the modification or even of the fact that h/she is learning a new word.

5.3. The Growth of Verbal Reasoning.

Variables such as accessibility of knowledge, effects of age, and intervention are all affected by the child's experience in a particular domain. Where experience was less, bottom-up processing of information of an inductive nature was expected. Where experience was greater, top-down processing of a deductive nature was expected, drawing on the children's store of memory, abstraction, and imagination. Bottom-up processing is data-driven, so that the child is depending on the input to a much greater extent and it is presumed can tolerate less interferences.

It was clear from these data that children used a variety of coding schemes or strategies in focusing their attention on the target in the testing. *But as long as these strategies did not entail an inappropriate rule formation, their impact was superficial.* The children's tacit representation of rules was clearly idiosyncratic in various characteristics. This personalised aspect of induction routines was well established in the sample as a whole.

Joos (1972) has spoken of the deciphering of unknown words as an "Aha" experience. The "Aha" experience has been equated with Insight thinking or creative thinking, and is described as follows :

> "The "aha" phenomenon is experienced when we are able to transcend the properties of the individual components that enter into and constitute a problem, and are suddenly able to organise the solution" (Notterman & Drewry, 1993, p. 107).

It should be noted, however, that Joos <u>also</u> stressed that before that type of experience takes place, various struggles and confusions occur. He has demonstrated this struggle for the "Aha" with his own pain over deciphering the Middle High German word "Gelaetet." Actually, this procedure is reminiscent of the theme of the Parzival story, from which the word is taken. The story tells of the pains that the hero suffers over himself and his circumstance in finding truth. At the time Parzival himself decides to surrender to the course of things and to truly have faith, the truth emerges unscheduled and in a natural flow.

The Parzival story surveys the relationship between the self and the world; for understanding to be revealed the hero must deal with himself in his total context and understand that relationship. That understanding is only brought forth when he surrenders to the whole and lets the pattern take the incidental course of action further--the least meaning is revealed.

When the children in the present studies were learning tacitly, it was necessary for them to raise their knowledge to awareness by having to answer questions about the stimulus materials or when there were demands on expression of their meanings of the target words. Hence, in order for the children to increase their knowledge of the new term from context embeddedness to declarative understanding and expression, bridging inferences were needed, and the experimental designs that I employed may not have given proper scope for that. Therefore, I argue, that designs in which the cursive act of thinking is brought forth are needed in future research into language development in order to estimate children's declarative abilities.

Einar Haugen (1951) who has evaluated Joos's (1950) theory of language as a design, has pointed out that even if deduction is an important factor in all language designs, the ordinary language user must have another constant on which to base his or her linguistic intuitions and that this is the non-linguistic experience of things, events taking place in the wider context. Knowledge of extralinguistic patterning is thus thought to provide a base for the understanding of linguistic patterning. Pointing to objects and naming them and/or teaching children the definitions of words and pointing out the logical relationships between words in hierarchies, using ostensive definitions, may therefore be necessary as a stage in language development in young children. Besides, experience and exercise with a given word and familiarity with the context of its use are needed by the child in order to decipher the least meaning.

Young children are often dominated and easily misled by perceptual appearance, whereas older children seem less bound by surface structure. This happened in my experiments with the Indirect children and also with children in the other conditions when working with the test sample materials. Older children had greater facility for solving problems, perhaps because of their ability to make use of symbolic transformation. During

Preschool and school-age years, integration of information increases from visual and verbal channels and can account for the superior performance of older children in the three studies. With growing age, the ideational content goes well beyond the concrete evidence, language gradually becomes the vehicle for thought, and verbal comprehension merges into higher intellectual processes, such as verbal reasoning. The evidence from the studies suggests that there is a close parallel between the age of the children and their ways of thinking and interpreting new words; also, the large sample should be representative of a group of children from the social backgrounds from which the subjects were selected; and the studies provide an evidence of the characteristic ways of interpretation and defining new words by children from age 4 to 12.

The context sensitivity of reasoning gives way to a more generalised understanding. Specific deductive explanations can be subsumed under more general, abstract, inclusive, or basic explanations. Deductive explanations are relatively independent of specific content or context and one can speculate if the inborn constraints Jackendoff (1983, 1984) and McShane (1991) argue for as part of the cognitive architecture are of a deductive nature; how else could a child realise that, when, for example, a new animal is named patas by an adult who points to it, the adult is speaking of the animal as a whole but not of a part of it such as its nose or its tail? Or how can the child, without deductions, know that some words denote substances and objects, i.e. nouns, whereas other words denote descriptive attributes, i.e. as adjectives do? There is, of course, no claim in these speculations for deliberate use of deductions in young children.

Verbal reasoning grows as the child's concepts develop gradually and are continuously being modified by experience, and, when relations that, at first, were raw, procedurally-based relations, become progressively more informed and more sharply determined. The general characteristics of a proper definition of a word are that it should state the class to which an object belongs and the features that distinguish it from other objects in the class; clearly, the definitions of many children failed to satisfy these criteria.

The results from the tests in the studies suggest that children can show referential knowledge earlier (such as they show in the tests of comprehension, i.e. Object Comprehension and Sign Comprehension) than they can show conceptual understanding (such as they show in the tests of Category and Interpretation, in direct metalinguistic questioning, and in Production). This may happen, not because their knowledge is so limited, but because their concepts are immature and/or because they don't understand what is required of them, as the task is not presented in terms that are meaningful to them or this type of experimental approach is outside their experience so that they show less linguistic ability than they are endowed with. Also, as the perception of the child's self in the world relates to his/her function and adaptation for which concrete experience and the context of the immediacy of the task is necessary, the child, lacking the availability to relate to concrete experience and to a natural dialogue in the tests of Category, Interpretation, and Production, is unsure of his/her function and that again affects performance.

The "high-scorers" in the studies were children who, regardless of condition, showed great sensitivity for syntax, had good working memories, and had the ability to find original solutions for the linguistic problems. These children appeared to have a strong intuitive sense and a trust in their own abilities, and were not easily misled. They had a strong sense of "*thingumbob,*" as James (1890) once said.

Joos (1950) has argued for a distributional definition of word meaning. Haugen (1951), who has evaluated Joos's thesis, has stressed the fact that the native speaker has learned to use the meaning of a word in substantially the same distribution as have other speakers of his or her language and that what s/he gives as the meaning is the replacement, a synonym or a circumlocution, which has approximately the same distribution in the language. According to Haugen, the point is that the speakers can do so only because they have a constant to which they may refer the question, namely their non-linguistic experience. Thus, an understanding of the rules of correspondence between linguistic and extralinguistic patterning is important.

To sum up, then, in order for children to learn the meaning of a new word, they need to work out both the extension and the intension of the word. In the studies described here, there were several children who had worked out some aspects of the new word's meaning from contextual information, as was the case with the Controls or from stimulus information, as was the case with the Indirects. Some of these children failed to integrate their knowledge, but could still make do, and established only a vague understanding. They were sensitive to syntax and to the word class in which the new word belonged. Jackendoff (1984) has developed the idea that once a language learner has learned the meaning of the construction in question, the observed syntactic distribution will follow automatically. He has argued for the importance of innate aspects of meaning in the very early stages of language acquisition that help shape the development of syntax. Lexical and grammatical generalisations are reflections, he maintains, of deeper generalisations rooted in the structure of cognition. He maintains that the language learner "Cannot acquire syntax without use of the correspondence rules: (s)/he must be independently guessing the meaning of utterances from context and putting it to use in determining syntax" (p. 51). Thus, the context-determined semantic interpretation of forms is not necessarily restricted to syntax. The etymology of many words shows that context-determined semantic interpretation of forms constitutes a basic mechanism for semantic change at the lexical level and is a basic factor in lexical reconstruction. It is clear, on basis of my results, that more work is needed within the field of both psychology and linguistics to clarify the relationship between linguistic and extralinguistic patterning--correspondence meaning-- in order to learn about factors influencing the lexical reconstruction of children's vocabularies, and, that, designing approaches to tap the holistic nature of such reconstruction depends on an improved understanding of correspondence meaning.

5.4. Word Use as compared to Word Meaning.

Striking differences between comprehension and production (see p. 293-294) were clearly established in all the age groups and between the conditions--Contol children usually performed worse in the tests of Production than did children in the intervening conditions. Even if children in the Control condition did not hear the word as often as did children in the other conditions, all children heard it the same number of times in the Test Phase. Children who had all tests of word meaning correct except for the production tests must have understood the meaning of the new term. Therefore, it cannot be said that what they were lacking was meaning in Production. Also, the test sample of objects employed in Production was a sample of the same objects employed in Comprehension and should therefore have been more familiar to the children. Thus, the differences could not either be related to the test sample of objects employed.

In conclusion, it can be stated, that the differences in performance on tests of comprehension and production could be: a) related to recognition for comprehending the meaning of the new word, which came earlier in all the age groups than the needed recall for production of the new word, and b) to the influence of the probing techniques--the experimental designs gave more scope in both the Encoding Phase and in the Test phase for the practise of the new term's comprehension than for its production as there were several more questions and tests for comprehension--verbal and nonverbal--than there were for production.

Dockrell (1981) had argued that the relationship between comprehension and production is not always systematic--it will depend on the conditions in which children encounter the new word and on their semantic competence--and--on the extent to which alternative labels are present in their vocabulary. She further argues that this contention is different from stating that comprehension and production are inherently not related.

Dockrell has argued that the production and comprehension of terms of reference would imply an underlying organisational process capable of guiding the application of a given word to an assortment of objects and actions. It is this categorisation process, which objectively manifests itself in children's actual choice of denotata for a given word, that constitutes the basis of a theory of the development of word meaning. Thus we must ask what criteria children use for restricting and extending the denotation of a new term. In turn, what relationship eventually holds between the various denotata such that they form a coherent whole, a concept? Researchers have usually ascertained the relationship between errors in production and in comprehension, rather than attempting to describe the intensional bases for these errors (Anglin, 1977, 1978). When children use familiar words such as "animal" or "cat" properly in many contexts, they still may have an immature understanding of these words. For instance, a child might call a cow "cat" or say "Rufus is not an animal; he is a cat." (See Ch.2, p. 27-28 on Comprehension and Production).

Overextensions in production were noted in the studies. They have been explained in many ways (Rescorla, 1980). The overextension of words during production can be seen as a communicative strategy. Bloom (1973) has maintained that productive overextensions arise because of limitations in vocabulary. If children do not know the proper term required, they may use some word related to it in meaning. Thus they may rely on relation in meaning that is possibly based on perceptual or functional criteria or on degree of similarity to a prototype. They might, for instance, say "silver" for "Mikas," "daffodil" for "Kelaph," or "caterpillar" for "Mimbo."

It should be noted that these mappings may not be cases of pre-emption. Gentner (1978) has proposed that children prefer to use a word they know well, because it places them on surer ground. Perhaps a different set of strategies is implemented for production, as when children use general-purpose words where a lexical gap exists or extend words the denotational boundaries of which are vague.

Huttenlocher (1974; Huttenlocher & Smiley, 1987) has argued that retrieval errors occur in labelling a referent. Whether an asymmetry really exists between the children's comprehension and production abilities is a much-disputed issue. Furthermore, evidence of comprehension may not be evidence of semantic knowledge. Children may have other strategies for understanding available to them so that what might at first be seen as comprehension of a lexical item, may, in reality, not involve semantic knowledge at all, i.e. children who are interpreting what is said to them are probably relying on pragmatic factors, intonation, and various nonverbal cues (Clark, Hutcheson & Van Buren 1974).

Studies involving comprehension are easier to design than are studies of production (Hoogenraad et al., 1978). Thus, experimental designs that have been made to elicit production have no guarantee of presenting the wanted data (cf. Thompson & Chapman's experiment, 1977). However, given that such an experimental design is successful, one must ensure that the equivalent knowledge is being tested in the comprehension task. During this task, the children must not have any alternative non-linguistic strategies with which to cope, that, however, was the case in the experimental designs of the present studies--the children were asked to name the materials or objects in the test sample.

To summarise, then, children's understanding of the basic aspects of syntax is developed by 4 or 5 years of age. However, their pragmatic understanding is based largely upon context and upon the reading of clues about the speaker and the physical environment (Donaldson, 1978). When they seem to understand what is said to them, it is misleading to assume that they have acquired a specific level of language skill per se. They may be relying more heavily upon cues of other kinds than upon the intension that the speaker has for the words that have been spoken. The results of the 3 experiments indicate that the children had more correct responses to tests of comprehension than to tests of production, which may indicate the general difference established in other studies between comprehension and production, but may, also, indicate that the tests in the experiments that were of a semantic nature and really screened the linguistic ability of the children were the ones of production.

5.5. The Value of using Drawings in the Experiments.

In the studies, information could be activated in memory that could be used to help retrieve the target word, but the children often did not have the metamemorial sophistication to use the information. The initial representational system of the child is procedural in nature and gradually shifts over the course of the preoperational period to one that includes major declarative components. Perceptual processing, of which I argue that language processing is one type, is largely procedural. Gradually, the child acquires the ability to access knowledge beyond the demands of the immediate procedural context. Mandler (1983, 1984) pointed out that the simplest form of this increased accessibility is the ability to recall absent things, to locate an item in memory without any current perceptual support. Bruner (1964) has spoken of multiple access as the ability to move around freely in a representational system. However, as Vygotsky (1962) has pointed out, little is known about the course of freeing parts of procedures into generally accessible pieces of knowledge. Vygotsky has stressed the referential nature of language--how, as a symbol system, it is used to refer to other knowledge, and how concepts undergo the change from being natural concepts of daily life experience to the scientific concepts of taxonomic hierarchies based on logical deductions. Preoperational thinking depends on images--static imagery more than kinetic, presumably--but later becomes subordinate to and influenced by operational thought. The drawings used in the studies may be important in this regard for young children. Bruner has argued that a change occurs, around six to eight years of age in the child's representational system, as the child begins, spontaneously, to use more symbolically and linguistically based kinetic imagery.

The use of drawings to tap understanding in the experiments proved to be extremely valuable. The drawing process involves planning, positioning, and alignment problems and is a complex task for the child. Freeman (1972) had criticised the lack of consideration for the children's performance factors involved when translating conceptual knowledge or a mental image into a recognisable representation or drawing, and has argued that this lack has led to the underestimation of children's knowledge. Freeman concluded that only when one understands how children draw can one interpret what conceptions and feelings drawings hide. Care must be taken when inferring knowledge and concepts from children's pictures; there are still many gaps in our understanding of their graphic intentions. Thomas and Silk (1990) have put it thus:

> Children in their drawings present different kinds of information. Early drawings may be no more than symbolic representations of the genus to which the drawing topic belongs. Later drawings often display object-centred information about the structure of the object depicted and (where appropriate) about the structure of the array of objects in the scene. Viewer-centred depictions are typically produced more frequently by children older than seven years. Performance factors often play a crucial role in determining the information apparently presented and must be recognized in any adequate attempt to draw inferences about children's knowledge and the kinds of information that they consider it important to present in their drawing (p.109).

Thomas and Silk hold that art is characterised by three properties: repleteness, expression and composition. They have argued that even infants are sensitive to composition and that drawings made by young children are often more artistically appealing than drawings made by older children. The drawing artistry of young children was well reflected in the present experiments.

Kellogg (1969) has suggested that all art can be understood as an independent visual order and that children, in their developmental process, proceed slowly from stage to stage and incorporate various sketches from earlier drawings, combining them in new ones. She further maintained that this developmental process is one of a logical, visual system and that the artistic action of children is based on visual thinking: they create different known gestalts, which in turn call into mind new gestalts. Kellogg has argued that children begin by receiving their ideas about structure from looking at their own scribbles. Her argument was that, for example, the first sun that children draw is not a symbol for the red sun in the natural world but that it stems from many types of line shapes that they have seen in their earlier scratch.

Lowenfeld and Brittain (1975) have spoken of children's active knowledge that shows their understanding of the world and their interests. They have argued that this knowledge is expressed in their drawings. They always draw what they know and what matters to them. Artistic expression is seen as an indivisible part of the overall development of children. Art in young children is seen as an unconscious self expression but within the span of development, older children learn to create art as an act without conscious forethought. Lowenfeld and Brittain have argued that children use material from their experiential background and that by interpreting and recreating it, they create "a new and meaningful whole" in which they manifest how they think and feel and see.

In the experiments, there were different developmental pathways of different individuals as well as the strategies shared by many. This is in line with the arguments put forth by Thomas and Silk. They pointed out that according to Gesell (1925), individual differences were related to a physiological/biological growth principle of each person within the limits of which much individual difference existed. I feel that Gesell's notions could be examined when evaluating the fact of individual differences and developmental diversity in the data from my three experiments.

In their review of the literature on drawing development, Thomas and Silk maintained that there were three factors presented in children's pictures: a) their knowledge of the topic, b) their interpretation of what is important in the picture, and c) their capacity to draw what they know. They argued that pictures present information having enough in common with that provided by the perception of the real world for the children's immediate identification of the object depicted. Freeman (1987) maintained that the abilities of younger children to present information has heretofore been grossly underestimated. The drawings of the youngest children in my studies confirm his notion.

There is still too little research probing the capabilities of children under the age of four to permit one to fill the gaps in the study of drawing development. There is some evidence now that even three-year-old children can create much more complex pictures than was previously thought (Thomas & Silk, 1990). This complexity was well established in my experiments with the drawings of the young children. Little has been done to investigate the drawings of children from their point of view and their thoughts about them. Asking them about their drawings could be a valuable tool in the study of language.

When children create a drawing, it may require considerable cognitive work--a complex achievement not merely requiring the projection of conceptual knowledge onto a sheet of paper. Arnheim (1969) believed thinking to be perceptual and argued that much thinking involved images and that pictures might facilitate thinking. Children's drawings, Arnheim argued, would have a helpful effect on their general cognitive development and help them solve particular problems. His notion is well supported by the data of the present experiments; the enjoyment with which the children experienced themselves in the drawing tests eased their communication and helped them reflect on their own thinking and doing.

Paivio (1971; Paivio & Csapo, 1973) has suggested that two forms of representations were employed for thinking: a verbal form and an imaginal code. Information, when coded, is either verbal or imaginal. The general conclusion is that drawing can facilitate thinking about ideas coded in images. Similarly, as was established by Vygotsky (1962), writing may facilitate thinking about ideas and information coded verbally, which often is the case with adults. Younger children may have more of their information coded imaginally; this is perhaps why the drawings were a better way for them to express themselves. Recently, Vygotsky's ideas on the value of drawings for development have been expressed thus:

> "Drawing marks the child's great discovery about symbols (both linguistic and non-linguistic ones)-about their potential to stand for the things as well as being things in their own right. This discovery leads to further development of abstract thinking, imagination and logical reasoning, since it allows children to perform a much wider range of operations within a system of symbols" (Lange-Küttner & Thomas, 1995, p.155).

Vygotsky's ideas of the value of drawing were incorporated in the experimental designs of the present studies, and, as the data shows, the tests of drawing proved very valuable.

The Clinical Value of Drawings.

The results of the developmental studies in this thesis can have implications for work, not only in the field of education, but also in the field of clinical disorders that are known to produce serious deficits in conscious, overt processes--what Campbell (1979) would term phenic processes. The fact of disjunct representations for a new word's meaning was well-established in these studies, especially in differences between tests of metalinguistic ability and direct definitions, as compared to tests of indirect measures such as those of drawings. Children's responses with these tests often showed disjunct representations; they might draw the referent properly but then categorise wrongly, or vice verse.

Dora Black (cf. Black et al., 1993) has recently argued for the therapeutic value of drawings as channels through which repressive memories can be expressed. She speaks of the photographic memory of children and argues that their minds have the ability to absorb the details of a given situation without their awareness being focused on these aspects of their situation. Implicit learning seems to be a factor here, in a way similar to the learning of the Control children in my Control conditions. In therapeutic work, as she has shown, drawings are of much value when working with children who have undergone repressed trauma. Black argues that children's conscious thinking and talk, what, according to Campbell (1979), can be termed the phenic aspect of mind, sometimes seems not to incorporate any disturbing memories of past traumatic events in the lives of these children. However, their drawings often reveal things that are very different from what they say or feel when they are confronted with direct questions. Thus, their drawings have revealed extremely traumatic scenes from their past.

Drawings in this regard can be useful in personality assessment or in order to diagnose a psychological problem. Besides, expressive skills are fostered in such drawings as a means of emotional expression of a clinical, therapeutic value.

The enjoyment with which many children in my studies produced their drawings was suggestive of the importance of their aesthetic needs, together with the importance and value that the young children had for visual thinking. On the other hand, since I did not attempt an analysis of their construction processes in making their drawings, I can say very little about their strategies of representation. Also, I am careful in interpreting their presentation of information in the drawings. Instead, I would like to point out that this aspect could be elaborated and worked out in new designs. Bruner (1964, 1966) stressed the effects of drawings and other forms of play in the development of early intelligence. In line with his argument, the success of the drawing tests may have been related to the ease of the situation that the children experienced. This scope for emotive ease and expression is of value when considering new designs for word learning in children, as it is clear from my data that several factors combine in the meaning of a new word for a child; also, giving direct definitions of word meanings in terms of logical relationships between words is not natural to the child, s/he may have much knowledge of the referent and drawing it may be the proper way to declare something about that knowledge.

5.6. The Social Dimension.

Several authors have emphasised the communicative interaction between child and adult and the child's need for the adult to paraphrase that which s/he is trying to express in order for their language to grow. In the following a light is shed on some of these notions and the bearings they have for the data of the present experiments.

Werner and Kaplan (1950, 1952) spoke of the difficulties that many of their subjects had had in their experiments in seeing the word as highly lexicalised and stable. Instead, the children perceived the lexical situation globally in which subjective and objective factors were not clearly differentiated. Donaldson (1992) argues that an objective attitude is needed in order for children to grow beyond the context embeddedness of their thinking. This phenomenon was quite strongly reflected in many protocols in my experiments. There were children who did not make the needed metacognitive assumptions in order to raise the unaware familiarity that they had of the meanings of the new terms and thus to raise their knowledge to the level of declarative expression. I suggest that one of the following factors was needed for declarative understanding: a) scaffolding, or the retelling of that which the children thought about the story or the new words, b) second trials for the children to rethink the information they had; or c) designs that incorporated the opportunity for their private speech or their self-expression, such as, for example, pretence play situations. Thus, the children could use their natural resources in order to reflect on their own thinking or doing.

Gordon Wells (1986a) has stressed the needs of children and a respect for these needs in language interactions with them. Thus, in order to be a good language model for a child, the adult should be sensitive to the child's level of understanding, his or her needs and interests and show empathy and interest; if the adult interferes with the natural needs of the child to create language and to work with it in a personal way, the adult may hinder the needed restructuring of the child's knowledge and vocabulary.

Karmiloff-Smith (1979, 1986) has argued that it is never sufficient to ask when a particular linguistic category is mastered behaviourally by the child. She has argued that focus must be placed on the representation of the function that a category has initially and the ways in which its functions evolve and change with time. She spoke of fundamental changes in children's underlying representations at eight years and beyond, when children start to cope abstractively with language. Then they reorganise the components of the "utterance grammar" they have mastered earlier, by age five, and acquire procedures for operating on spans of cohesively related utterances, thereby changing the functions of their earlier-mastered categories. She has argued that children treat the language they are hearing as a formal problem space. The results of the present studies showed a general growth in comprehension with age.

Carey (1985) has contended that concepts undergo change in the mind of the incumbent. However, the extension of a concept may not be subject to radical change, even if children initially seem to understand many concepts, but the knowledge structure of the concept is continually enriched and refined. How conceptual change takes place may, according to Carey, be determined by the beliefs that children hold about the process of other conceptual change as determined by the knowledge structure of their other concepts; the growth of knowledge having not only to do with the personal world of self but also with the interactions of the child with his/her social world..

A crucial factor in the studies was the asymmetry in status between the children and the experimenter. The children used certain words in a different sense than adults use them. The way in which the questions were presented may have influenced their answers in a special way. There were limitations to the children's technique and the intentional aspects may have been a problem of communication between the child interviewee and the adult interviewer (cf. Pikas, 1966); a lack of proper interaction and a lack of paraphrase of the child's language may have suppressed their natural heuristics in a way similar to what a formal instruction might do. Also, tiredness may have been a factor, given that children were faced with so many questions. However, it was clear that most children were not distracted by the experimental set up and were adaptive; more striving for the "Aha" was seen than had been expected.

Bruner (1964) spoke of self-regulatory abilities in children and of their "principal creative activity" over and beyond the construction of abstracted coding systems. He argued for the "principal creative activity" as the combination of the resultant of learning to deal with needs in the establishment in behaviour of general regulatory systems. The needs of the children in my three experiments may have been underestimated, so that this natural self-regulatory ability became suppressed. Thus, a monitoring ability may exist in language acquisition that detects and corrects errors. The needs of the children may be important factors in their restructuring of the meaning of the new terms even if the restructuring happens initially at tacit levels.

In a similar line of reasoning, Bruner (1983) has emphasised the social base of language learning in children, the importance of communicative interactions with adults and older children in social exchanges, such as in primitive forms of give and take play of objects during the first year. This type of communication he has called the "language acquisition support system" (Lass). Chomsky (1973, 1980, 1986) spoke of the language acquisition device, the Lad that he took to be innate, an inborn tendency to learn the rules of language and to create and modify them). By the Lass, children learn various language formats that help them understand many aspects of language use long before they themselves can use language; to learn to exchange objects may later become a base for learning to take turns in conversations. Bruner argues for an interdependency of the Lad and the Lass, by which the child is enabled to participate in the language community and in the culture to which the language is a key.

Werner (1950) has stressed the importance of the cognitive and conative needs of children in their language acquisition. He distinguished between literal perception, in which objects are perceived according to their objective geometrical-technical qualities, and physiognomic perception, in which objects are perceived through the motor and affective attitudes of the subject. He argued that affect may be a necessary prerequisite for accurate and rational cognition and that factors are effective in semantic change that are not rooted in the logical operations of thought. Thus, regulation of motive expression through concept formation should not be underestimated. The developmental aspects of phenomena such as expressive, symbolic processes underlying change of word meanings, and underlying melodies produced by 2.6-to-5-year-old children were studied by Werner, who concluded that aesthetical aspects are very important for children. I think these aesthetical needs of children should be studied further, in new designs that better tap the issue of language acquisition.

Much regulatory activity takes place within the children themselves and among them in interaction with others in the course of language development. The communication interaction between parent and child happens in a variety of ways. Expressions used by the mother to refer to entities in the environment are understood by the child as references to just these entities and not to other, irrelevant entities. Input to the child is simplified, the parent talks slowly, uses shorter utterances, repeats key words, and uses a higher pitch (Trevarthen, 1977). The child identifies the units that make up the utterance, selectively attends to the stressed elements of the adult utterance, extracts the major content words, and largely ignores the rest.

Catherine Snow (1987; Snow & Ferguson, 1977) has proposed that mothers of young infants speak to them about what is happening and what can be expected to happen long before the infants start to speak. She argues that this behaviour helps the infants to structure their world, to discriminate between events and different actions and to anticipate future events. She demonstrated that mothers of young infants believe their infants to be valid communicative partners, and that this belief has much to do with the growth of communicative skill and strengthening of language in their children.

Other important interactive patterns of behavioural reference occur in the achievement of visual coorientation when the child follows another person's gaze; those patterns also support linguistic reference. Both these regulatory activities emphasise the environmental support of non-linguistic patterning and the value of direct, ostensive definitions. The cognitive system of the child seems to be constrained to treat ostensive definitions as names for whole objects; otherwise the child might, for example refer to stripes on an animal's back, as a part of the whole animal. Thus, the child does not have to eliminate the various logical possibilities; s/he simply does not consider them in the first place.

In sum, the results of the present studies should be looked at in the light of the lack of interaction and lack of paraphrase that the experimental setups gave rise to; these restrictions were necessary in order to run the studies as controlled experiments.

5.7. Applications of the Results.

The application of the results of the studies is now described. I consider the main issues in this realm to be: a) the design and subsequent new designs b) the need for psychological insight when estimating the word definitions of children, and c) the applications of the tests and their implications for work in the educational and the clinical field.

The Design and New Designs.

One of the basic aims of the experimental designs was to develop understanding of how rich and complex knowledge would be obtained in the Control condition, independent of overt, conscious strategies for acquisition. With the Controls, it was clear that verbal context without non-linguistic support could be informative to the children, provided that the linguistic information was sufficient to specify the denotation of the term. At the same time, one must bear in mind that part-of-speech (here a natural-kind nominal) was a variable that must be considered in its own right when investigating the word-learning abilities of young children and when designing new approaches.

For an understanding of the partial knowledge that the children gained in the different conditions employed in the three studies, understanding of both structural and metamemorial influences are important. Thus, the ability of the children to perform in these experiments is due to memories of prior experiences with the word, contextual determiners, and to information supplied by the language system. Durso (Durso & Shore, 1991) has argued similarly. He maintains that: "savings of unrecognised words and semantic decisions about unknown words both appear to suggest that general constraint information is present in the memory trace" (p. 193).

Dockrell (1981) has stressed the point that children learn language and the meaning of new words often without direct instructions, through tacit restructurings taking place over time, which, she argues, the young word learner needs favourably without interferences. The experiments presented in this thesis are based on this hypothesis. A basic implication of the present experimental data is the question of bridging inferences, of the manner in which children raise to awareness the knowledge that they have of the meanings of new words after enough time. Further, the data is suggestive of the contribution of such factors as repetition, auditory skills, private speech, cursive thinking, memory, personal will, and a notion of incidentally learning from interactions with the environment. These factors are the ones I would like to stress as being important when the children make the needed bridging inferences between their knowledge and the demands of the situation when probed for recognition of words and declarative skill, bearing in mind, that, *private speech*, according to Vygotsky (1962), both helps to relate the children to *the social world* by monitoring their activities and to relate them to *their inner world of self* and thus helps thought and language to fuse and become an integrated whole (cf. the experiment of Wykes & Johnson-Laird, 1977 and a description of it in Ch.1, p. 12-14).

Therefore, I regard it as important, with new designs in the line of research presented in this thesis, to create situations for children in which bridging inferences are made possible, together with controlled procedures for estimating these. This procedure would involve greater repetition of subject matter for Control subjects than was required in my studies and more availability of the cursive act of thinking and speech and self-cueing for young children than my designs allowed for. A procedure is needed that structures the child's situation to the extent that *sufficient interaction with the adult and with the private world of the child is provided.* This is the procedure that, I suggest, should be followed in future designs with my Control condition: repeated readings without any interferences. Until this is done, we will not have a fair comparison between the performance of Control children and Experimental children who often learnt from the interferences of their condition.

The general implication from my studies is that, in the case of learning the meanings of new words from sentential contexts, children should be given enough time to learn about the subject matter. Words are best learned in their natural context, implying that they are acquired as a by-product of learning about subject matter. This subject matter must be introduced so as to evoke the interest of children and to help them correlate new knowledge with old knowledge. What has emerged from my experiments is that, in order to learn the intension of new words, children should be exposed to new words over a period of time, encountering them in several contexts without interfering with the processes of semantic reorganisation. Verbal intelligence based on accumulated knowledge is thus fostered. However, I do suggest that,: a) how children encode the meaning of the new word depends on whether they hear the story in which the word is embedded only once or two or three times, before being tested on it, and b) how they are tested on the meaning of the new word is important--whether, for example, they are tested once or twice or given second trials. Mandler (1983, 1984) maintained that the more an individual knows about the subject matter being read, the more s/he can use his or her previously acquired knowledge in a top-down fashion to interpret new knowledge. For the children to know subject matter well may enable them in future designs to become "good guessers."

The children generally showed enthusiasm for the tasks in the experiments. They were involved in their tasks, so that the experimental manipulation was a natural part of the interaction. Of course the structured tests were not representative of natural word-learning situations. Nevertheless, different types of encoding clearly affected the performance of the children. It may not have resulted in differences in learning scores but in differences in decoding and in the qualitative aspects of learning. An example was the Control children's sensitivity for the intensions of the new words, as compared to the Experimental children's sensitivity for the extensions of the new words.

Assessment and Psychological Insight.

The children in the studies used many different forms of definition to explain the meaning of the new term, depending apparently on their knowledge of the word, their encodings, and their understanding of what was required of them. It is difficult to classify all these forms of definition; however, three broad classes can be discerned: a) definition based on emotional-tone or conational attitude--i.e. physiognomic--denoting rudimentary classifications that express commands or desires ("mum has a gold bracelet"; "bad bird named Popo"; "little creatures that grow"; "the bird ate it") b) definition based on a specific context and specific instances that associates meaning with a specific situation ("its hard and the sun gets it hot"; "they used it to decorate with"), and c) definition that is generic in type and reveals a mature concept (per genus et differential) definition based on the superordinate concept, the genus of the word ("its metal and metal is a mineral": "it is a plant").

As Denny has argued, a habitual semantic use of words influences our lack of reflecting upon their conceptual meanings. Burns (1958) has stressed the need to assess the word definitions of children, not only by a logical criterion, but also by a psychological criterion that is based on insight into the ways children think and adjust in the world. Burns (p. 38) takes as examples to illustrate his contention the following remarks from his vocabulary studies, the experimenter asks: "the accusation is unjust," the child answers: "you accuse somebody when you say-you've done it;" experimenter: "the city corporation," and the child says: "people to whom we pay rates and in return, they clean the streets;" and, experimenter: "he showed great friendliness," and the child answers: "kindness to help."

Burns described this need for a psychological insight when assessing children's definitions in the following:

> Definitions at this level are, perhaps, evidence of a habitual use of the words in these situations rather than of any inability to deal with abstract concepts as such; and the apparent inability of older children to give adequate definitions of more complex concepts can be similarly explained. Often their acquaintance with a word is limited to two or three contexts, which is a very small basis for determining genus and species. In such cases, any definition that states or implies the generic relationship and exemplifies it in a particular way, would seem to be satisfactory, despite its logical limitations (p. 37-38).

To sum up, children in all the age groups clearly found that using descriptions of the meanings of new words--by adhering to the contexts in which the words were learned and used--much more convenient than attempting to give special definitions--by declaring the logical relationships between concepts at different levels of hierarchical structure, such as saying: "Mikas is metal and metal is a mineral." This was such a strong feature of the research that I would argue it is one of the basic results of the studies, and gives much support to Joos's ideas of connotations of words when deciphering text. Connotations are vague.

As I have stressed throughout the thesis, a balance is needed between the conscious overt and the unconscious covert that exists in a real situation. How that balance is achieved may be linked to the development of consciousness, in which the development of emotion may be as important as the development of intellectual modes. Donaldson (1992) has argued similarly and adds that if more concern was given to emotions and their role in development was respected, children could live a better life, and society, into which the child is initiated through language, would work better.

Applications of the Tests and their Implications for Educational and Clinical Work.

I believe that I now have strong grounds on which to argue that the **tests** designed for my experiments could be used **in future practice** as *screening tests* for linguistic skill, as they both tap verbal comprehension and visual imagery, assuming that language is not only based on logical relationships but on intuitive analogies as well. The tests could be used together with intelligence scales and tests of performance abilities. The results of each test in the three experiments could be used as a base to find which tests tap linguistic abilities best. I discovered the value of these designs as diagnostic and educational tools when I worked with children in the experiments who were known to have low linguistic abilities but better nonverbal abilities (according to standard IQ measures). In the sample, for example, there was a young boy of seven whom I knew. He had been diagnosed with speech and language-expression difficulties. He was confused on the tests that required direct metalinguistic answers but was always confident about his drawings and thus showing disjunct representations of the new term. If the drawing test had been omitted altogether his results had shown his hampered expressive ability, and, also a lack of comprehension, and therefore a biased testing profile of his comprehensive abilities.

I consider the test of drawing an important tool to include in standard psychological testing procedures of cognitive and/or linguistic abilities; a tool that both facilitates communication with the child and gives a fairer estimate of his/her range of abilities and of the interrelatedness of their functions. (I have used such a testing procedure for some years now in educational psychology with Icelandic schoolchildren).

The functional separation of conscious and unconscious cognitive processing has recently emerged from the study of various patient populations. In cases such as amnesia, blindness, prospagnosia, and alexia there is now evidence for effective performance in the absence of awareness (Reber, 1989a). However, very few studies have as yet been conducted into the effects of implicit versus explicit learning in the face of serious psychological and neurological disorders. Reber (1989a) has maintained that older primitive systems in evolutionary biology are more resistant to physical insult than are newer, more complex systems and that these primitive systems should show greater resistance via implicit cognitive processes than should the explicit processes of the younger system. In a recent study, he and his co-worker have suggested (Abrams & Reber, 1989) that even the acquisition of knowledge is undiminished as long as the task is a nonreflective, nonconscious task. They worked with a mixed population of institutionalised depressives, schizophrenics, and alcoholics with organic brain damage in an implicit grammar learning task and an explicit short-term memory task. On the explicit memory task, the patients performed worse than a normal control group (similar to what can be said to have happened to the Metalinguistic children in the present studies); whereas the performances of the two groups were statistically indistinguishable on the implicit learning task. Actually, the results of the Indirect children in the present studies can be taken to indicate the resistance of the older evolutionary systems. As there were several children who overcame the interference effects of their condition and incidentally learned the meanings of the target words, there is the question if they were learning from the type of encoding that they underwent, or, more importantly, if their old and primitive systems (via which implicit cognitive processing took place) resisted change and survived the blur.

I take the general good performance of the children in all conditions and in all age groups to indicate the existence of these older systems. I cannot relate that good performance only to learning opportunities and/or shortcomings of the experimental designs.

I consider this work to have significance in the clinical field, both as a manner of studying consciousness in children and adults, and to give patients renewed faith in themselves and as a way to open for them the possibility of learning new adaptive strategies and possibilities. To this, one can add Joos' (1972) remark that: "we never know how much we know after all" (p. 260). Whorf (1956) has pointed out the phenic and cryptic division of consciousness and how trapped people can become by phenic, habitual thought processes. He stated this as follows:

> In the understanding of a large linguistic pattern there is involved a partial shift of focus away from the versatile psychic activity. Such understandings have even a therapeutic value. Many neuroses are simply the compulsive working over and over of word systems, from which the patient can be freed by showing him the process and pattern (p. 269).

Whorf's example shows well the importance of raising to awareness erroneous thinking and, by doing so, opening up for new ways of learning.

Furthermore, new designs and tests based on them could be based also on other measures, such as reaction time and physiological measures. It would be interesting to run such tests on all the age groups studied in this thesis.

The results of the studies may have implications in education in the field of reading. As the young children in the studies were not good at synthesising incidents and analytical, logical definitions were not natural to them, the question as to how subject matter is presented in text is important. Studies of children's narrative abilities (Berman & Slobin, 1986; Peterson & McCabe, 1991) show a marked growth in such abilities between ages of five and nine, as measured by the length of their stories, their reference to major plotline components and by an increase in linking of events and experiences, in terms of temporal sequence and of causal relationships, and in the number and diversity of subordinate clauses. The stories of the youngest children are picture-dependent and do not have a global episodic structure whereas narratives by the older children have an overarching episodic structure and observable actions and events are explained in terms of goals, motives, thoughts and emotions of the central story characters.

On basis of the present experiments, I suggest that perceptual, artistic presentation based on sensory images rather than a logical, analytical presentation is likely to meet the level of the younger child's understanding and interest better (cf. Wells, 1986a). Phrases and expressions that convey visual images, experience and information, stories with a series of actions, drama and poetry are more likely to help regulate the needs of children and to help structure their concepts and enhance the growth of their vocabulary.

For the growing child, language is a sensational affair.

Conclusions.

This thesis addressed the process of semantic development in children of 4 to 12 years. In particular, there were two emphases: a) the observation of developmental differences in children's acquisition of the meanings of unfamiliar words from linguistic contexts and b) the examination of the effects of experimental interventions on the lexical entries for these new words during continuous assessment.

The present work has left me with an awareness for the contribution that the overall development of the children and their function in the areas of cognitive, emotional, and communicative achievements has for their developing word meanings. The functional role of the children's intrapersonal and interpersonal interactions is well reflected in their growing awareness of the subject/object relationship and the strife towards full meaning. Thus, one main conclusion is the light the studies shed on the processes of context embeddedness and decontextualization in the growing children and what these tell about the function of their minds in the various psychological and social aspects of the experiments.

In order for the children to construe meaningful discourse in the experimental circumstances, they must participate in communication with the adult experimenter in a very constrained setting. Vygotsky (1962) had argued for the dynamic unity of many psychological processes and for a functional, interrelatedness between such processes as language development, writing, and drawing in a socio-cultural context. He had maintained that for the child to develop the ability to represent the world symbolically in decontextualised ways *drawings* make great contributions towards such development. The results confirm Vygotsky's notions and indicate the validity of the drawing tests for the children to master these demands and to perform at the level of their ability. These results have, therefore, great implications for new experimental designs, for standard psychological testing, and for educational practices as they show that children can be supported to learn language, to comprehend and to express it by having at the same time access to their growing writing and drawing skills, and, that,: "these processes, each in its own way, enhance the child's mastery of discursive communicative skills" (Lange-Küttner & Thomas, 1995, p. 153).

Mastery of discursive communicative skills is linked to the sharpening of the polarity between the child's self and the world and to the process of decontextualization. As there was a lack of expressive settings--for speech, dialogue, cursive thinking and meaningful context--in the present experiments, the results may, however, show less ability than children of normal IQ have for learning language.

Marková (1991) has stressed the individual and societal development of knowledge and has pointed out that whatever stand one takes towards the evolution of concepts, they always develop in the environment and/ or in the person's interaction in the social world:

> If universals are considered to be the basis for concepts rather than concepts themselves, then the question that needs attention is how this genetic endowment is *actualized* - i.e. how does the basis for a concept become a concept? In other words, what is the role of the individual's environment in this process? If, on the other hand, universals are considered to be concepts, it is their relationship with the knower's active involvement with the world that must be the subject of concern (p. 97).

In agreement with Marková's argument, and, in concluding, defining words may be a process of learning about the social implications of a word; that, again, may be a result of the child's linguistic abilities, his/her experience and social being in the world. *Function is a core issue here.*

At first, the young child tends to apprehend the word as dynamically related to and dependent on himself and embedded in the *particular* instances of the context. There is a noted lack of sharpening of the polarity between the young children and the world in the present studies--their word meanings are partial--but, more importantly, such performance of the children indicates that in natural settings these partial meanings would have adaptive value for the function of the children and convey enough clues to the proper word meaning to be understood by their communicative partners; the ability to make logical deductions, and mature significations based on the *general*, the *universal*, emerge at a later stage (cf. Werner, 1948).

The observed modes of thinking, conceptualising, feeling, and perceiving in the data represent phases in the children's developments of the meanings of the new words, developments that may be linked to their consciousness and social growth as *selves* in the *world*. With such complex material as language (cf. Brooks, 1978) children may early--and incidentally--learn to rely on intuitive analogies and tacit self-regulatory mechanisms. Their personal linguistic intuitions about the meanings of words and their reading of contextual clues in the studies show that they are mostly within the proper semantic field in their guesses. The proper word meaning and the abiltiy to declare a full meaning definiton certainly take time to grow. However, the underlying and rapid heuristic identification of the new word meaning survives more blur and the children show more adaptation than I initially hypothesised. In order to function in the midst of competing stimuli such adaptation in language for the growing child is tenable.

On basis of the results, the main notions of this thesis are confirmed, namely, that different phases are involved in the composition of a word within text, and in the deciphering of that composition from contextual to acontextual meaning.

Final Comments.

It is clear to me, after working with so many children of different ages, that various phases of knowledge interact in lexical acquisition.

What I would like to stress in conclusion is the fact that researchers are often not stating whether the skills they think children use in their deciphering of unknown words are cognitive skills or some other skills. Might they not just as well be skills of intuition, of intuitive analogies; of imagination? The matrices Joos (1972) spoke of, on which we must rely for inverse probabilities to reveal the least meaning of a word consistent with the context, need not be deductive <u>logical</u> matrices--they might be <u>intuitive</u> matrices of the imagination (and of a cryptic nature, whether inductive or deductive: a mystery). The language (including text) that we hear is not only of a cognitive character--it is also audial, even musical, symbolic and of an implicate order--holographic.

Besides, the concept of cognition, as it is often used, is far too complex and badly stated most of the time, whereas in older accounts consciousness was seen as the function of discernment, giving rise to the components of perception, conception, and volition.

It is clear to me, after having completed the work presented in the thesis, that more work is needed in order to learn more about implicit learning on basis of what ever new theories may emerge.

Therefore, I conclude this thesis in the hope that some of the information gained in these developmental studies can be suggestive of further developmental work and have some implications for the progression of the concepts we use in research, such as cognition, insight thinking, intuition, and imagination. The work has left me with an awareness of the complications of these notions and how seldom in the present-day literature they are related to the notion of human consciousness.

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PHASES OF KNOWLEDGE IN LEXICAL ACQUISITION: A DEVELOPMENTAL STUDY INTO FOUR TO TWELVE YEAR OLDS DECIPHERMENT OF UNFAMILIAR WORDS FROM LINGUISTIC CONTEXTS DURING CONTINUOUS ASSESSMENT.

APPENDICES

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Ph.D. IN PSYCHOLOGY.
1996.

APPENDIX A
(PILOT STUDY AND EXPERIMENT 1)

The Story Used in the Pilot Study of More and Less.

(Examples of Testing with Fiona, age 3.11, are shown, along with the relevant scores.)

Donald Duck and his nephews' shopping day

One fine day Donald Duck and his nephews Huey, Louie and Dewy decided to go downtown to buy new bikes for the boys as their old ones were getting too small for them. They got up early and dressed, and as they are quite noteworthy ducks, they always like to wear their caps when shopping. Now, they had to decide which caps to wear this special day.

Which shelf has	caps?	(example: more)	1
Which shelf has	caps?	(example: less)	1
Which shelf has	caps?	(example: red)	0

They decided to wear the blue caps and now they all three went out of their house and to the car park to find their car. There were two car parks in their street which had many cars in them.

Which car park has	cars?	(example: less)	1
Which car park has	cars?	(example: green)	0
Which car park has	cars?	(example: more)	1

They got into their small red car and off they went for the shopping centre downtown. But as it was early morning and they hadn't had their breakfast yet, they decided to go first to Auntie Daisy for breakfast. Auntie Daisy was certainly glad to see them and offered them two plates full of biscuits she had just baked.

Which plate has	biscuits on it?	(example: more)	0
Which plate has	biscuits on it?	(example: brown)	0
Which plate has	biscuits on it?	(example: tiv)	0

They all liked the biscuits very much and after having eaten well of them they thanked Auntie Daisy and went back to their car. Now they drive carefully towards the town-centre. Just before coming there, there was a big and beautiful park along the road. There they parked their car and went for a walk in the park. And what a sight it was, all the beautiful flowers in the flowerbeds, and the many trees with their sprinkling green leaves and some with fruit already.

Which flowerbed has	flowers in it?	(example: more)	0
Which flowerbed has	flowers in it?	(example: tiv)	0
Which flowerbed has	flowers in it?	(example: orange)	1

In one corner of the park there were some apple trees, some with red apples and some with green. Huey, Louie and Dewy very much wanted to pick some, but they knew it was forbidden, so instead they counted all the apples.

Which apple tree has	apples on it?	(example: less)	1
Which apple tree has	apples on it?	(example: more)	1
Which apple tree has	apples on it?	(example: red)	0

After wandering around in the park for a while, Donald Duck and his nephews walked to the shopping centre and looked in the shop windows for some bikes. They passed many shops before finding any selling bikes. Of all the shops there, they liked the top shop best. In its window they saw balloons, blue and yellow and red in small boxes. They decided to go in and buy some.

Which box has	balloons in it?	(example: tiv)	1
Which box has	balloons in it?	(example: blue)	0
Which box has	balloons in it?	(example: more)	1

Later when they came home they would blow up their balloons and tie them with string to the handlebars of their bikes. It would certainly be nice to cycle around with their balloons blowing in the wind. But then they would need to buy good string as well. And they asked if they could see the trays with the strings.

Which tray has	strings in it?	(example: more)	1
Which tray has	strings in it?	(example: less)	1
Which tray has	strings in it?	(example: blue)	0

Off they went now with their balloons and strings to find their new bikes to buy. On the very next corner they found a shop with many bikes, big and small. In they rushed to take a good look around. Finally they decided on very fine orange bikes which stood in one of the shop windows.

Which window has	bikes?	(example: tiv)	0
Which window has	bikes?	(example: more)	0
Which window has	bikes?	(example: red)	0

They asked to have their new bikes immediately sent home and then they hurried back to their car and set off for home. And in the afternoon that very same fine day, you could see Huey, Louie and Dewy happily cycling around in their home streets with their blue caps on their heads and their balloons tied with a beautiful string to the handlebars of their bikes; the balloons softly blowing in the wind.

The pictures accompanying the story are presented on the following pages. (Fig. A.1., A.2., p. A4-A5).

Figure A.1. Sample Set of Stimulus Materials in Pilot Study

Figure A.2. Sample Set of Stimulus Materials in Pilot Study

The Story Used in the Encoding phase of Experiment 1.

The Secret Fate of Planet OC.

Section 1.

The starship Skyfax is heading for its destiny in a distant galaxy. The captain of the ship, Wilfred Cook and his crew have been sent on a special mission to look for the remains of an ancient civilisation on planet OC. The OC race was quite famous in the Ancient World for its love of peace and sound lifestyle. A good supply of Mikas supported the OC's culture. One day some external danger seems to have threatened the OC's happy existence and completely destroyed them. Many centuries have passed since then, in the the course of which men have made attempts to get to planet OC, but always in vain, due to the fact that their starships have been too weak in power. Finally now, men on planet Earth have managed to build a starship with quite powerful engines which according to their calculations are strong enough to reach OC where they hope to find some cues to the secret fate of the OC civilisation.

Section 2

Skyfax is now out of our known galaxy and is soon entering a galaxy in the Milky Way noone from planet Earth has been to before. Soon captain Cook gets planet OC on the radar screen and starts to prepare for the landing. Everything seems to work out well. They land at the entrance to a big valley. As they leave the starship they take their helpful robot C-1B with them. When they start to look around, they see in the middle of the valley the ruins of what seems to have been an old city. The only building which is still in a reasonable state is a huge temple near some rocky hills above. Everything is deathly quiet. No animals, plants or life forms of any kind can be seen anywhere. Huge layers of sand lie all around. There is something glittering in the sand; it is Mikas which does not wear off easily. Suddenly their robot C-1B gets very excited and unfortunately stumbles over some ruins and falls forwards. He lies like this for a while complaining, but then gathers himself together and hurries towards the temple. What is his excitement all about?

Section 3

Captain Cook and his men now decided to follow C-1B up to the temple. As they approached, they began to hear a soft sound coming from it, as if some things were being banged together, like bells or shields. When they came closer, they saw a big bell hanging outside the entrance to the temple. The beautiful sound came from that bell. C-1B nodded continuously and looked quite pleased. As they stood silently beneath the bell and contemplated on its sound and elegant shape, the temple doors started to open up for them and they entered a big and beautiful hall. Their voices echoed strangely in there because of all the Mikas in the hall. What now caught their attention was an altar standing in the middle of the hall. On it there lay an old manuscript with some funny sort of an inscription. Clearly, these are picture signs, they thought. They might provide cues to the secret fate of the OCs. As soon as they had the idea the bell started tolling again as if it was commenting on their thoughts.

Section 4

Fortunately, C-1B had been programmed for the decipherment of unknown languages. He might perhaps accomplish the task of translating the picture signs in the altar manuscript. At last, after much puffing, C-1B had the answer decoded. Much to their surprise, they now realised that this OC code was very similar to the picture signs code once used on Earth in ancient Egypt thousand of years ago and there known as hieroglyphics. The message C-1B translated ran as follows:

> "If you have come as men of peace and benevolence, the entrance bell will greet you and open up the huge temple doors with the help of our secret formulas. You have made the sincere effort of seeking knowledge of our fate. Go to the bottom of the valley for more information."

This message sounded rather puzzling, but Cook and his men decided to follow the advice given. When they came out of the temple, the bell started tolling again and the temple doors closed slowly. As they headed towards the city ruins again, they had the funny feeling that the bells' beautiful sound would always remain in their hearts like a guiding star and a gift of the secret wisdom of the OCs. Once out of the ruined city, they came to a countryside of many farm ruins circled by fences made of Mikas. At the valley's bottom they saw a small loch. What information would they find there?

Section 5

It was already twilight when they reached the loch. The loch was very clear and quiet. There was no sign of life to be seen anywhere. The men stared curiously at the loch. This mission was very special to them all. But they would all have felt quite lost here on OC if they had not found the message in the temple. The bell over there had surely been a great help and so had their C-1B. Yes. They had to admit they would never have got so far without advanced technology. But what was so special about this loch here? What was the information that the altar manuscript had spoken of? Suddenly their brainracking was disturbed by C-1B. He stood there on the shore nodding eagerly and pointing at something glittering in the middle of the loch. What could this be out there? Captain Cook decided to try swimming over to find out. When he came closer he saw this was a tiny satellite. Now he got really curious. He managed to lift the tiny satellite out of the water and swam carefully with it to the shore where the others awaited him in a state of excitement. When out of the water Cooks clothes were soaking wet whereas the Mikas he had kept in them from the temple was wet, but of course not soaking as it does not get soaked by water. Cook happily handed the tiny satellite over to his friends. They all felt a great relief at this new discovery.

Section 6

Cook, C-1B and the other of the Skyfax team took the tiny satellite over to the starship. They decided to have some rest now as it was getting very late. They had a long and good sleep and when they woke up the next morning the sun was shining burning hot. They managed to open up the tiny satellite by the use of an electric current from C-1B. Inside it they found a picture sign message which once translated ran as follows:

> "OC. Year 4020. January 15th. An alien force from planet x-12 has succeeded in getting through our defences. Now our civilisation and all life

forms on the planet have been destroyed by their powerful fire weapons. Most of the race has been taken into slavery. Others have died. We have never exploited our scientific knowledge to produce weapons. Instead it has been used for the good and benefit of all. As we don't want our scientific knowledge to fall into the hands of such a savage people who would use it to serve their urge for power and dominance in the Universe, a few of us have attempted at escaping with it in one of our rockets. Much of our secret knowledge is also hidden within this tiny satellite which we shot down and is self directed to the loch after everything is over. When the right time comes for your race , our secret knowledge hidden within the satellite will reveal itself. Keep it well. May you live in peace."

Captain Curdin.

The Skyfax team was now ready to depart from planet OC. They now hold the answer to the secret fate of the OC. Before leaving they paid their last farewell to the temple and the city ruins. Captain Cook's hand brushed against something in the city ruins made of Mikas which the sun's rays had made terribly hot, and burnt himself. When on his way back to Skyfax, Cook thought of all the happy OC people living here once. And as he entered his starship and turned to have a last look at planet OC, he wondered if the OC's beautiful dream of peace would ever come true.

The Story Used in the Posttest.

One Sunday morning in May a few years ago the following news was read in the Icelandic radio:

> "A team of geologists who have been working in the Highlands the past weeks at measuring the thickening of our largest glacier, Vatnajokull, found earlier this morning a wee satellite near a cave Southeast of the glacier."

It is now known that the following message which the university's computers have been working on was found in the satellite:

> "We are a team of geologists coming from a distant galaxy. Our leader is the ruler of an old kingdom on one of its planets. Our ancient culture is supported by a plentiful supply of Mikas which we have on the planet. As we were not sure whether our spacecraft was strong enough to enter Earth's atmosphere we decided to send down to your country this satellite. If you can decode this message it is clear that your science is far enough advanced to make you capable of contacting our galaxy within a few years time and answer our request. We undertook this mission to look for cobalt on other planets which we now need to improve our technology. Do you have cobalt in your country which you would like to exchange for some Mikas?"

Quantitative Data.

In the following pages quantitative data from Experiment 1 are presented that are complimentary to the data already presented in the Results section of Chapter 2 (p. 80-95).

Patterns of Within-Children/Between-Children Responses.

In the 5-year-old group, no child in the Indirect, Metalinguistic, or Control conditions received perfect scores on all five tests--not even on all tests 1, 2, 3, and 5 with the Production test (T4) omitted. However, two children in the Metalinguistic Plus Indirect condition scored perfectly on four correct tests--on all but Production.

In the 7-year-old group, two children in the Indirect group received perfect scores on all tests and a third received perfect scores in all but T4. Five subjects in the Metalinguistic group received perfect scores on all five tests, as did five in the Control group and six in the Metalinguistic Plus Indirect group; two others received perfect scores in all but T4.

In the 9-year-old group, nine subjects in the Indirect group received perfect scores on all tests, as did four in the Metalinguistic group. Three others received perfect scores on all but T4. In the Control group, five subjects received perfect scores on all tests and three received perfect scores on all but T4. In the Metalinguistic Plus Indirect group, eight subjects received perfect scores on all tests.

In the 11-year-old group, eight subjects in the Indirect group received perfect scores on all tests--nine not counting T4. Six subjects in the Metalinguistic group received perfect scores on all tests--seven not counting T4. Six children in the Control group received perfect scores on all tests--seven not counting T4. Eight subjects in the Metalinguistic Plus Indirect group received perfect scores on all tests; nine received perfect scores on all but T4.

Table A.1.

Percentages of Correct Responses to the Tests in the Test Phase in Experiment 1.

Age	Condition	T1	T2	T3	T4	T5
5	Indirect	30%	0%	10%	10%	50%
5	Metalinguistic	30%	0%	10%	0%	50%
5	Metaling. + Indirect	60%	20%	30%	30%	50%
5	Control	30%	20%	40%	0%	70%
7	Indirect	70%	50%	50%	50%	60%
7	Metalinguistic	60%	70%	60%	70%	90%
7	Metaling. + Indirect	90%	80%	90%	60%	100%
7	Control	90%	80%	70%	50%	100%
9	Indirect	100%	100%	100%	100%	100%
9	Metalinguistic	70%	70%	60%	50%	90%
9	Metaling. + Indirect	100%	80%	100%	90%	100%
9	Control	80%	80%	90%	50%	80%
11	Indirect	100%	90%	80%	100%	100%
11	Metalinguistic	80%	90%	90%	70%	90%
11	Metaling. + Indirect	100%	90%	100%	90%	100%
11	Control	80%	80%	80%	70%	100%

Figure A.3.

Percentages of Correct Responses for Age and Condition.

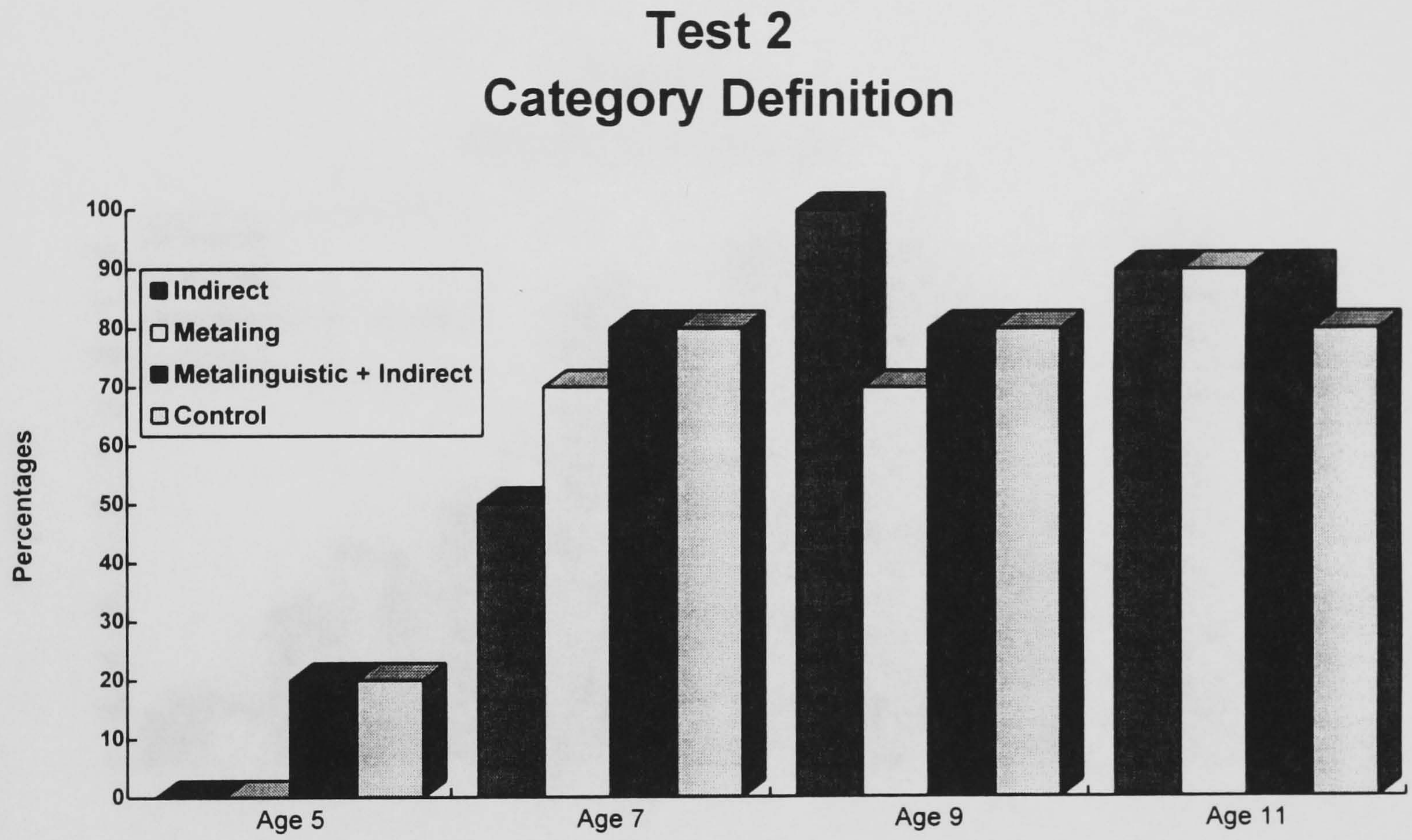

Figure A.4.

Percentages of Correct Responses for Age and Condition.

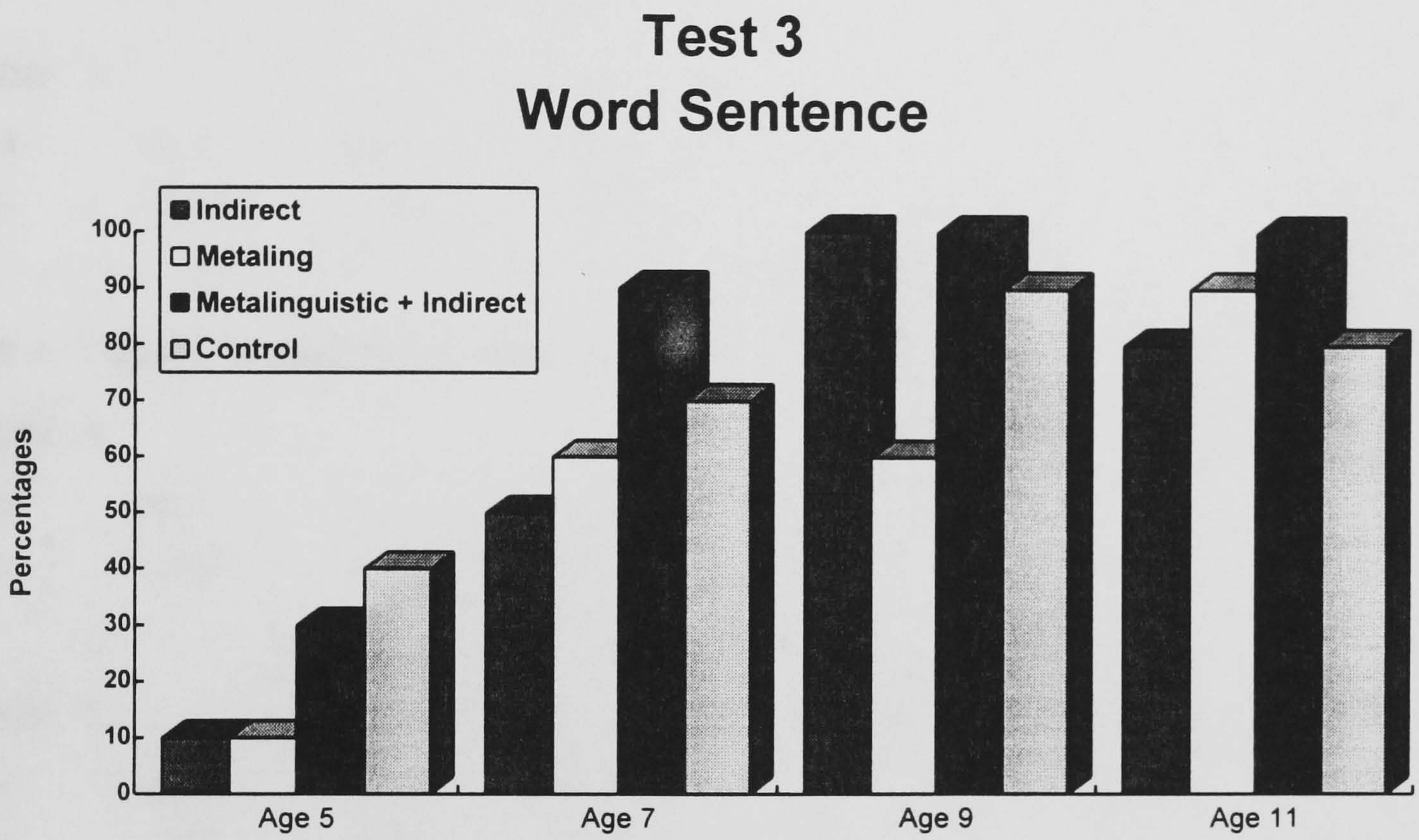

Table A.2.

Duncan Multiple Ranges Test for Age and Condition in Experiment 1

THE SUBSETS

Test 1 - Object Comprehension (Condition)

SUBSET 1

Group	Grp 2	Grp 1	Grp 3
Mean	.6000	.7179	.7500

SUBSET 2

Group	Grp 1	Grp 3	Grp 4
Mean	.7179	.7500	.8780

Test 1 - Object Comprehension (Age)

SUBSET 1

Group	Grp 1
Mean	.3750

SUBSET 2

Group	Grp 2	Grp 3	Grp 4
Mean	.7805	.8750	.9231

Test 2 - Category Definition (condition)

SUBSET 1

Group	Grp 2	Grp 3	Grp 1	Grp 4
Mean	.5750	.5750	.6667	.6829

Test 2 - Category Definition (Age)

SUBSET 1

Group	Grp 1
Mean	.1000

SUBSET 2

Group	Grp 2	Grp 3
Mean	.7073	.8000

Test 3 - Word Sentence (Condition)

SUBSET 1

Group	Grp 2	Grp 3	Grp 1
Mean	.5500	.6000	.7179

SUBSET 2

Group	Grp 3	Grp 1	Grp 4
Mean	.6000	.7179	.8049

Test 3 - Word-Sentence (Age)

SUBSET 1

Group	Grp 1
Mean	.2250

SUBSET 2

Group	Grp 2
Mean	.6829

SUBSET 3

Group	Grp 3	Grp 4
Mean	.8750	.8974

Test 4 - Production (Condition)

SUBSET 1

Group	Grp 1	Grp 2	Grp 3
Mean	.4359	.4750	.6500

SUBSET 2

Group	Grp 2	Grp 3	Grp 4
Mean	.4750	.6500	.6829

Test 4 - Production (Age)

SUBSET 1

Group	Grp 1
Mean	.1000

SUBSET 2

Group	Grp 2	Grp 3
Mean	.5854	.7250

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

SUBSET 3

Group	Grp 3	Grp 4
Mean	.7250	.8462

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

Test 5 - Depiction (Condition)

SUBSET 1

Group	Grp 3	Grp 2	Grp 1	Grp 4
Mean	.7750	.8000	.8718	.8780

- -

SUBSET 3

Group	Grp 3	Grp 4
Mean	.8000	.8974

Test 5 - Depiction (Age)

SUBSET 1

Group	Grp 1
Mean	.5500

- - - - - - - - - -

SUBSET 2

Group	Grp 2	Grp 3	Grp 4
Mean	.8780	.9250	.9744

- -

Table A.3.

Correlation Matrix with STD for the Tests in the Test Phase in Experiment 1

Variable	Cases	Mean	Std Dev
OBCOM	160	.7375	.4414
CRIDEF	160	.6250	.4856
WOSEN	160	.6688	.4721
PROD	160	.5625	.4976
DEPIC	160	.8313	.3757

Correlations:	OBCOM	CRIDEF	WOSEN	PROD	DEPIC
OBCOM	1.0000	.5942**	.4553**	.5619**	.5277**
CRIDEF	.5942**	1.0000	.6343**	.6441**	.5472**
WOSEN	.4553**	.6343**	1.0000	.5839**	.4629**
PROD	.5619**	.6441**	.5839**	1.0000	.4773**
DEPIC	.5277**	.5472**	.4629**	.4773**	1.0000

N of cases: 160 2-tailed Signif: * - .01 ** - .001

Effects of Age and Condition on Performance in the Posttesting.

Posttest 1. Comprehension Mikas.

Two way Anova shows significant main effects of Age F (3,144) = 44.18, p<.001. and a significant interaction effect of condition and Age F (9,144) = 2.68, p<.01. Age group 11.5 performed best overall, with the Metalinguistic and Indirect condition giving the best results, except in age group 5.5, where the Control condition did.

Posttest 2. Production Mikas.

Two way Anova shows significant main effects of Age F (3,144) = 41,32, p<.001. Age group 11.5 performed best overall, with the Control condition giving the best results in all agegroups, except age group 9.5, where the Metalinguistic and Indirect and the Indirect conditions did.

Posttest 3. Comprehension Cobalt.

Two way Anova shows significant main effects of Age F (3,144) = 11.59, p<.001. Age group 7.5 performed best overall, with the Control condition suiting age group 5.5 best, the Metalinguistic and Indirect condition suiting age group 7.5, the Metalinguistic, Indirect and Control conditions Age group 11.5 suiting age group 9.5, and the Control condition suiting age group 11.5 best.

Posttest 4 Production Cobalt.

Two way Anova shows significant main effects of Age F (3,144) = 6.01, p= 001. Age group performed best overall, with the Control condition giving the highest results for the younger age groups and the Metalinguistic condition for the older age groups.

Combined Posttests:

Post Comprehension - Combined for PT1+PT2

Two way Anova shows significant main effects of Age F (3,144) = 54.13, p<.001 and a significant interaction effect between condition and age F (9.144) = 2.31, p<.05.

Age group 11.5 performed best overall. The Control condition gives the best results in age groups 5.5 and 11.5 (and 7.5, along with the Metalinguistic and Indirect condition) and the Metalinguistic condition and the Indirect condition in age group 9.5.

Combined Tests.

Age group 11.5 did best overall in both Test 4 and Comprehension, with the Metalinguistic and Indirect condition giving the best results in both cases also, except for in Test 4, age group 5.5, where the Control condition did.

Posttest 2 (Production Mikas) and Posttest 1 (Comprehension Mikas). In both posttests, the 11.5 year age group performed best overall, with the Metalinguistic and Indirect condition giving the best results in both posttests except in age group 5.5 in Posttest 1, where the Control condition did.

In Test 4 (Production) and Test 1 (Object Comprehension) combined, agegroup 11.5 performed best overall. The Metalinguistic and Indirect condition had the best effects on all age groups in Test 1 and the younger two age groups in Test 4, where the Indirect condition had the best effects on the older age groups.

Table A.4.

Summary Table for Two-way Anovas for all Tests in Experiment 1

	OBCOM	OBJECT COMPREHENSION
BY	COND	CONDITIONS
	AGROUP	AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	9.001	6	1.500	10.191	.000
COND	1.569	3	.523	3.554	.016
AGROUP	7.413	3	2.471	16.787	.000
2-way Interactions	.776	9	.086	.586	.807
COND AGROUP	.776	9	.086	.586	.807
Explained	9.777	15	.652	4.428	.000
Residual	21.198	144	.147		
Total	30.975	159	.195		

	CATDEF	CATEGORY DEFINITION
BY	COND	CONDITIONS
	AGROUP	AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	15.843	6	2.640	18.258	.000
COND	.420	3	.140	.969	.409
AGROUP	15.438	3	5.146	35.582	.000
2-way Interactions	.832	9	.092	.639	.762
COND AGROUP	.832	9	.092	.639	.762
Explained	16.675	15	1.112	7.687	.000
Residual	20.825	144	.145		
Total	37.500	159	.236		

	WOSEN	WORD SENTENCE
BY	COND	CONDITIONS
	AGROUP	AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	13.254	6	2.209	15.221	.000
COND	1.628	3	.543	3.739	.013
AGROUP	11.646	3	3.882	26.750	.000
2-way Interactions	1.292	9	.144	.989	.452
COND AGROUP	1.292	9	.144	.989	.452
Explained	14.546	15	.970	6.682	.000
Residual	20.898	144	.145		
Total	35.444	159	.223		

	PROD	PRODUCTION
BY	COND	CONDITIONS
	AGROUP	AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	14.530	6	2.422	15.095	.000
COND	1.758	3	.586	3.652	.014
AGROUP	12.697	3	4.232	26.383	.000
2-way Interactions	1.744	9	.194	1.208	.294
COND AGROUP	1.744	9	.194	1.208	.294
Explained	16.274	15	1.085	6.763	.000
Residual	23.101	144	.160		
Total	39.375	159	.248		

DEPIC DEPICTING
BY COND CONDITIONS
AGROUP AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	4.732	6	.789	6.967	.000
COND	.327	3	.109	.964	.412
AGROUP	4.412	3	1.471	12.992	.000
2-way Interactions	1.412	9	.157	1.386	.199
COND AGROUP	1.412	9	.157	1.386	.199
Explained	6.144	15	.410	3.618	.000
Residual	16.300	144	.113		
Total	22.444	159	.141		

Full Meaning (Combined tests T1 - T5)
BY COND CONDITIONS
AGROUP AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	263.974	6	43.996	25.764	.000
COND	17.579	3	5.860	3.431	.019
AGROUP	246.190	3	82.063	48.056	.000
2-way Interactions	19.222	9	2.136	1.251	.269
COND AGROUP	19.222	9	2.136	1.251	.269
Explained	283.196	15	18.880	11.056	.000
Residual	245.904	144	1.708		
Total	529.100	159	3.328		

Compreh (Combined tests T1+T2+T4+T5)
BY COND CONDITIONS
AGROUP AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	159.419	6	26.570	24.178	.000
COND	12.130	3	4.043	3.679	.014
AGROUP	147.355	3	49.118	44.697	.000
2-way Interactions	11.310	9	1.257	1.144	.336
COND AGROUP	11.310	9	1.257	1.144	.336
Explained	170.730	15	11.382	10.357	.000
Residual	158.245	144	1.099		
Total	328.975	159	2.069		

COMMI COMPREHENSION MIKAS
BY COND CONDITIONS
AGROUP AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	14.379	6	2.397	22.993	.000
COND	.566	3	.189	1.809	.148
AGROUP	13.814	3	4.605	44.179	.000
2-way Interactions	2.512	9	.279	2.678	.007
COND AGROUP	2.512	9	.279	2.678	.007
Explained	16.891	15	1.126	10.804	.000
Residual	15.009	144	.104		
Total	31.900	159	.201		

PRODMI PRODUCTION MIKAS
BY COND CONDITIONS
AGROUP AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	17.788	6	2.965	21.050	.000
COND	.328	3	.109	.776	.509
AGROUP	17.458	3	5.819	41.318	.000
2-way Interactions	1.874	9	.208	1.478	.161
COND AGROUP	1.874	9	.208	1.478	.161
Explained	19.662	15	1.311	9.307	.000
Residual	20.282	144	.141		
Total	39.944	159	.251		

COMCO COMPREHENSION COBALT
BY COND CONDITIONS
AGROUP AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	8.191	6	1.365	6.597	.000
COND	1.019	3	.340	1.642	.182
AGROUP	7.191	3	2.397	11.583	.000
2-way Interactions	1.986	9	.221	1.066	.391
COND AGROUP	1.986	9	.221	1.066	.391
Explained	10.177	15	.678	3.279	.000
Residual	29.798	144	.207		
Total	39.975	159	.251		

PRODC PRODUCTION
BY COND CONDITIONS
AGROUP AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	2.357	6	.393	3.106	.007
COND	.085	3	.028	.225	.879
AGROUP	2.279	3	.760	6.007	.001
2-way Interactions	.528	9	.059	.464	.897
COND AGROUP	.528	9	.059	.464	.897
Explained	2.885	15	.192	1.521	.105
Residual	18.209	144	.126		
Total	21.094	159	.133		

POST (Combined posttests COMMI - PRODC)
BY COND CONDITIONS
AGROUP AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	117.839	6	19.640	18.619	.000
COND	5.643	3	1.881	1.783	.153
AGROUP	112.453	3	37.484	35.537	.000
2-way Interactions	15.769	9	1.752	1.661	.104
COND AGROUP	15.769	9	1.752	1.661	.104
Explained	133.608	15	8.907	8.444	.000
Residual	151.892	144	1.055		
Total	285.500	159	1.796		

POST2 (Combined posttests COMMI+PRODMI)
BY COND CONDITIONS
AGROUP AGEGROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	57.385	6	9.564	27.746	.000
COND	1.460	3	.487	1.412	.242

AGROUP	55.975	3	18.658	54.130	.000
2-way Interactions	7.173	9	.797	2.312	.019
COND AGROUP	7.173	9	.797	2.312	.019
Explained	64.557	15	4.304	12.486	.000
Residual	49.636	144	.345		
Total	114.194	159	.718		

Table A.5.

Summary Table for Means in all Tests in Experiment 1

Condition	*Group 1* Mean Std. Dev. Cases	*Group 2* Mean Std. Dev. Cases	*Group 3* Mean Std. Dev. Cases	*Group 4* Mean Std. Dev. Cases
Summaries of Object Comprehension by levels of Conditions and Agegroups				
	5,5 yrs	*7,5 yrs*	*9,5 yrs*	*11,5 yrs*
Control	0,3000 0,4830 10	0,9000 0,3162 10	0,8000 0,4216 10	0,8889 0,3333 9
Metalinguistic	0,3000 0,4830 10	0,6000 0,5164 10	0,7000 0,4830 10	0,8000 0,4216 10
Indirect	0,3000 0,4830 10	0,7000 0,4830 10	1,0000 0,0000 10	1,0000 0,0000 10
Metaling. and Indirect	0,6000 0,5164 10	0,9000 0,3015 11	1,0000 0,0000 10	1,0000 0,0000 10
Summaries of Category Definition by levels of Conditions and Agegroups				
	5,5 yrs	*7,5 yrs*	*9,5 yrs*	*11,5 yrs*
Control	0,2000 0,4216 10	0,8000 0,4216 10	0,8000 0,4216 10	0,8889 0,3333 9
Metalinguistic	0,0000 0,0000 10	0,7000 0,4830 10	0,7000 0,4830 10	0,9000 0,3162 10
Indirect	0,0000 0,0000 10	0,5000 0,5270 10	0,9000 0,3162 10	0,9000 0,3162 10
Metaling. and Indirect	0,2000 0,4216 10	0,8182 0,4045 11	0,8000 0,4216 10	0,9000 0,3162 10
Summaries of Word Sentence by levels of Conditions and Agegroups				
	5,5	*7,5*	*9,5*	*11,5*
Control	0,4000 0,5164	0,7000 0,4830	0,9000 0,3162	0,8889 0,3333

	10	10	10	9
Metalinguistic	0,1000 0,3162 10	0,6000 0,5164 10	0,6000 0,5164 10	,9000 0,3162 10
Indirect	0,1000 0,3162 10	0,5000 0,5270 10	1,0000 0,0000 10	0,8000 0,4216 10
Metaling. and Indirect	0,3000 0,4830 10	0,9091 0,3015 11	1,0000 0,0000 10	1,0000 0,0000 10

Summaries of Production by levels of Conditions and Agegroups

	5,5 yrs	*7,5 yrs*	*9,5 yrs*	*11,5 yrs*
Control	0,0000 0,0000 10	0,5000 0,5270 10	0,5000 0,5270 10	0,7778 0,4410 9
Metalinguistic	0,0000 0,0000 10	0,7000 0,4830 10	0,5000 0,5270 10	0,7000 0,4830 10
Indirect	0,1000 0,3162 10	0,5000 0,5270 10	1,0000 0,0000 10	1,0000 0,0000 10
Metaling. and Indirect	0,3000 0,4830 10	0,6364 0,5045 11	0,9000 0,3162 10	0,9000 0,3162 10

Summaries of Depiction by levels of Conditions and Agegroups,

	5,5 yrs	*7,5 yrs*	*9,5 yrs*	*11,5 yrs*
Control	0,7000 0,4830 10	1,0000 0,0000 10	0,8000 0,4216 10	1,0000 0,0000 9
Metalinguistic	0,5000 0,5270 10	0,9000 0,3162 10	0,9000 0,3162 10	0,9000 0,3162 10
Indirect	0,5000 0,5270 10	0,6000 0,5164 10	1,0000 0,0000 10	1,0000 0,0000 10
Metaling. and Indirect	0,5000 0,5270 10	1,0000 0,0000 11	1,0000 0,0000 10	1,0000 0,0000 10

Summaries of Full Meaning (Combined tests T1 - T5) by levels of Condition and Agegroups.

	5,5 yrs	*7,5 yrs*	*9,5 yrs*	*11,5 yrs*

	1,6000	3,9000	3,8000	4,4444
Control	1,0750	1,2867	1,8135	1,0138
	10	10	10	9
	0,9000	3,5000	3,4000	4,2000
Metalinguistic	1,1005	2,0138	1,7764	1,3166
	10	10	10	10
	1,0000	2,8000	4,9000	4,7000
Indirect	0,8165	1,9322	0,3162	0,6749
	10	10	10	10
	1,9000	4,2720	4,7000	4,8000
Metaling. and Indirect	1,7288	1,1909	0,6749	0,4216
	10	11	10	10

Summaries of Comprehension (Combined tests T1+T2+T3+T5) by levels of Conditions and Agegroups,

	5,5 yrs	*7,5 yrs*	*9,5 yrs*	*11,5 yrs*
	1,6000	3,4000	3,3000	3,6667
Control	1,0750	0,8433	1,4944	0,7071
	10	10	10	9
	0,9000	2,8000	2,9000	3,5000
Metalinguistic	1,1005	1,5492	1,3703	0,9718
	10	10	10	10
	0,9000	2,3000	3,9000	3,7000
Indirect	0,7379	1,5670	0,3162	0,6749
	10	10	10	10
	1,6000	3,6364	3,8000	3,9000
Metaling. and Indirect	1,4298	0,8090	0,4216	0,3162
	10	11	10	10

Summaries of Comprehension Mikas (Posttest 1) by levels of Conditions and Agegroups.

	5,5 yrs	*7,5 yrs*	*9,5 yrs*	*11,5 yrs*
	0,3000	1,0000	0,7000	1,0000
Control	0,4830	0,0000	0,4830	0,0000
	10	10	10	9
	0,2000	0,9000	1,0000	0,9000
Metalinguistic	0,4216	0,3162	0,0000	0,3162
	10	10	10	10
	0,2000	0,4000	1,0000	0,9000
Indirect	0,4216	0,5164	0,0000	0,3162
	10	10	10	10
	0,2000	0,9091	1,0000	1,0000
Metaling. and Indirect	0,4216	0,3015	0,0000	0,0000
	10	11	10	10

Summaries of Production Mikas (Posttest 2) by levels of Conditions and

Agegroup.

	5,5 yrs	7,5 yrs	9,5 yrs	11,5 yrs
	0,2000	0,3000	0,5000	1,0000
Control	0,4216	0,4830	0,5270	0,0000
	10	10	10	9
	,2000	0,2000	0,9000	0,9000
Metalinguistic	0,4216	0,4216	0,3162	0,3162
	10	10	10	10
	0,0000	0,1000	0,9000	0,7000
Indirect	0,0000	0,3162	0,3612	0,4830
	10	10	10	10
	0,0000	0,2727	0,7000	0,9000
Metaling. and Indirect	0,0000	0,4671	0,4830	0,3162
	10	11	10	10

Summaries of Comprehension Cobalt (Posttest 3) by Conditions and Agegroups.

	5,5 yrs	7,5 yrs	9,5 yrs	11,5 yrs
	0,3000	0,7000	0,6000	0,8889
Control	0,4830	0,4830	0,5164	0,3333
	10	10	10	9
	0,2000	0,9000	0,6000	0,5000
Metalinguistic	0,4216	0,3162	0,5164	0,5270
	10	10	10	10
	0,1000	0,5000	0,6000	0,4000
Indirect	0,3162	0,5270	0,5164	0,5164
	10	10	10	10
	0,1000	0,9091	0,5000	0,4000
Metaling. and Indirect	0,3162	0,3015	0,5270	0,5164
	10	11	10	10

Summaries of Production Cobalt (Posttest 4) by levels of Conditions and Agegroups.

	5,5 yrs	7,5 yrs	9,5 yrs	11,5 yrs
	0,1000	0,2000	0,1000	0,3333
Control	0,3162	0,4216	0,3162	0,5000
	10	10	10	9
	0,0000	0,0000	0,3000	0,4000
Metalinguistic	0,0000	0,0000	0,4830	0,5164
	10	10	10	10
	0,0000	0,0000	0,2000	0,3000
Indirect	0,0000	0,0000	0,4216	0,4830
	10	10	10	10
	0,0000	0,0909	0,2000	0,3000
Metaling. and Indirect	0,0000	0,3015	0,4216	0,4830

	10	11	10	10

Summaries of Post Comprehension (Combined posttests COMMI+PRODMI) by levels of Conditions and Agegroups.

	5,5 yrs	*7,5 yrs*	*9,5 yrs*	*11,5 yrs*
	0,5000	1,3000	1,2000	2,0000
Control	0,8498	0,4830	0,9189	0,0000
	10	10	10	9
	0,4000	1,1000	1,9000	1,8000
Metalinguistic	0,5433	0,5676	0,3162	0,6325
	10	10	10	10
	0,2000	0,5000	1,9000	1,6000
Indirect	0,4216	0,7071	0,3162	0,6992
	10	10	10	10
	0,2000	1,1818	1,7000	1,9000
Metaling. and Indirect	0,4216	0,6030	0,4830	0,3162
	10	11	10	10

Total cases = 160.

APPENDIX B
(EXPERIMENT 2)

The Story Used in the Encoding phase.

The Thunderbird Clan of Pima.

Section 1.

The Pimas were a Red-Indian clan who lived in the Arizona deserts of North America. Their land was a yellow desert of salt brush, scarce water and rare rivers. Peculiarly shaped sandstone rocks were scattered around in the landscape. Against all odds, the Pimas had endured in this lonely land as naturally as the mountains themselves. They were the descendants of an ancient clan who had lived in the same desert surroundings for at least nine thousand years. The Pimas called their ancestors "Those who have gone" and held them in great respect. In spite of their desert land, the Pimas were farmers and grinders of meal. They had learned from their ancestors how to dig canals throughout their land to bring water to the vegetation. They planted corn and pumpkin and hunted the little desert deer whose skin they used for clothing. They collected the Kelaphs in the desert and used them to dye their soft deer skins red.

Section 2.

The Pimas believed in the Great Spirit in the sky. Occasionally, or so they believed, The Great Spirit manifested himself in the disguise of a bird of an enormous size. They held the bird in great awe and called it the Thunderbird. By the work of the Thunderbird the Earth was watered and vegetation grew. He carried a lake of fresh water on his back which caused a great downpour when he flew through the air. Also the Pimas believed that lightning flashed from his beak and that the beating of his wings was the rolling of thunder. The Pimas saw the Thunderbird as a guardian of their old clan. Incidents of warfare with other clans were few, and the Pimas never fought a war except to defend their territory. Their worst enemies were the Apaches. The medical knowledge of the Pimas' ancestors had taught them how to heal their warriors' wounds by using a bandage of some crushed Kelaphs. Another dangerous enemy of the Pimas was Gila, the desert monster which they feared more than anything else. However, the question remains whether the Gila was an actual monster or a tall dust monster that arose every noon because of the whirling winds that then swept the desert.

Section 3.

The Pimas were singers of songs and they loved to dance. They performed their dances at special full moon festivals to honour the Great Spirit in the disguise of the Thunderbird. Usually, if the Thunderbird was seen he was accompanied by a flock of other birds, mostly magpies and Baregs. The Pima girls always came to the Thunderbird festivals with little jingling copper dance bells around their ankles whereas the Pima boys took along their small deer spears decorated for the occasion with feathers and wrapped beadwork. The grown up Pimas all wore engraved seashells as ornaments on their clothing. These shells had been traded from clans who lived near the Pacific Ocean. The Pimas had learned to use the acid juice of the tough skinned Kelaphs to engrave designs on the shells.

At the Thunderbird festivals everyone gathered in front of the high priests lodge. This was no ordinary lodge. Although it was a simple house of poles and thatch, like all other Pima lodges, the Pimas saw it as a house enveloped in white winds and white clouds, full of noble spirits, some of whom were the spirits of their ancestors, and to whom they turned for guidance.

The Story Used in the Posttest.

For the American Indians, land was endless as the sky and belonged to no man. They saw it as the Great Spirit himself whom they should foster and worship. Still the Pima Indians of Arizona gather at special festivals to honour the Great Spirit. They all then put on their soft deer skin clothing that they have dyed yellow by using kelaphs they have collected. They bring some deer meat as offerings to the Great Spirit soaked in the juices of crushed Astas.

Quantitative Data.

In the following pages quantitative data that compliment the data presented in the Results section of Ch. 3 (see p. 165-180) are shown.

Patterns of Within-Children/Between-Children Responses.

In the 4-year-old group for Indirects, only two children had all tests correct; and with T3 omitted, no one had all other tests correct. In the same age group for Metalinguistics, only one child had all tests correct; and with Test 3 omitted, no one had all other tests correct. In the same age group for Controls, only one child had all tests correct; and with Test 3 omitted, no one had all other tests correct.

In the 6-year-old group for Indirects, only one child had all tests correct; and with T3 omitted, one child had all other tests correct. In the same age group for Metalinguistics, only one child had all tests correct; and with T3 omitted, two children had all other tests correct. In the same age group for Controls, only two children had all tests correct; and with T3 omitted, three children had all other tests correct.

In the 8-year-old group for Indirects, only two children had all tests correct; and with T3 omitted, four children had all other tests correct. In the same age group for Metalinguistics, three children had all tests correct and with T3 omitted no one had all other tests correct. In the same age group for Controls, one child had all tests correct; and with T3 omitted, three children had all other tests correct.

In the 10-year-old group for Indirects, five children had all tests correct; and with T3 omitted, one child had all other tests correct. In the same age group for Metalinguistics, six children had all tests correct; and with T3 omitted, no one had all other tests correct. In the same age group for Controls, seven children had all tests correct; and with T3 omitted, three children had all other tests correct.

Table B.1.

Percentages of Correct Responses to the Tests in the Test Phase in Experiment 2.

Age	*Condition*	*T1*	*T2*	*T3*	*T4*	*T5*	*T6*
4	Indirect	50%	50%	31%	44%	50%	44%
4	Metaling.	38%	56%	31%	63%	44%	31%
4	Control	44%	69%	13%	75%	63%	38%
6	Indirect	50%	75%	31%	56%	56%	25%
6	Metaling.	38%	56%	19%	44%	69%	81%
6	Control	63%	81%	19%	75%	88%	75%
8	Indirect	50%	63%	19%	69%	63%	56%
8	Metaling.	44%	56%	44%	44%	56%	50%
8	Control	50%	75%	25%	69%	75%	75%
10	Indirect	88%	75%	63%	63%	69%	56%
10	Metaling.	75%	69%	50%	69%	81%	56%
10	Control	81%	100%	50%	81%	75%	75%

Figure B.1.

Percentages of Correct Responses for Age and Condition.

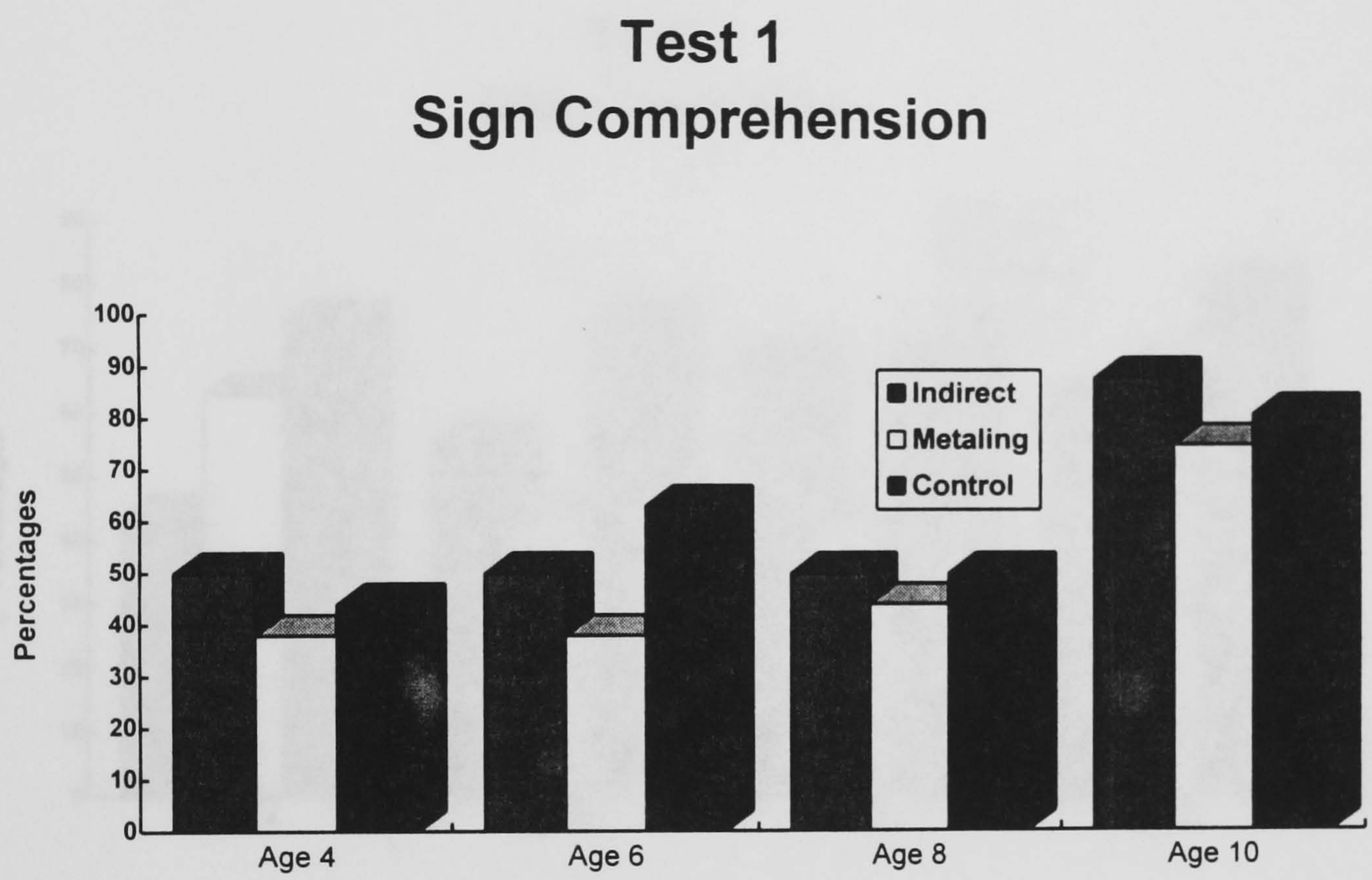

Figure B.2.

Percentages of Correct Responses for Age and Condition.

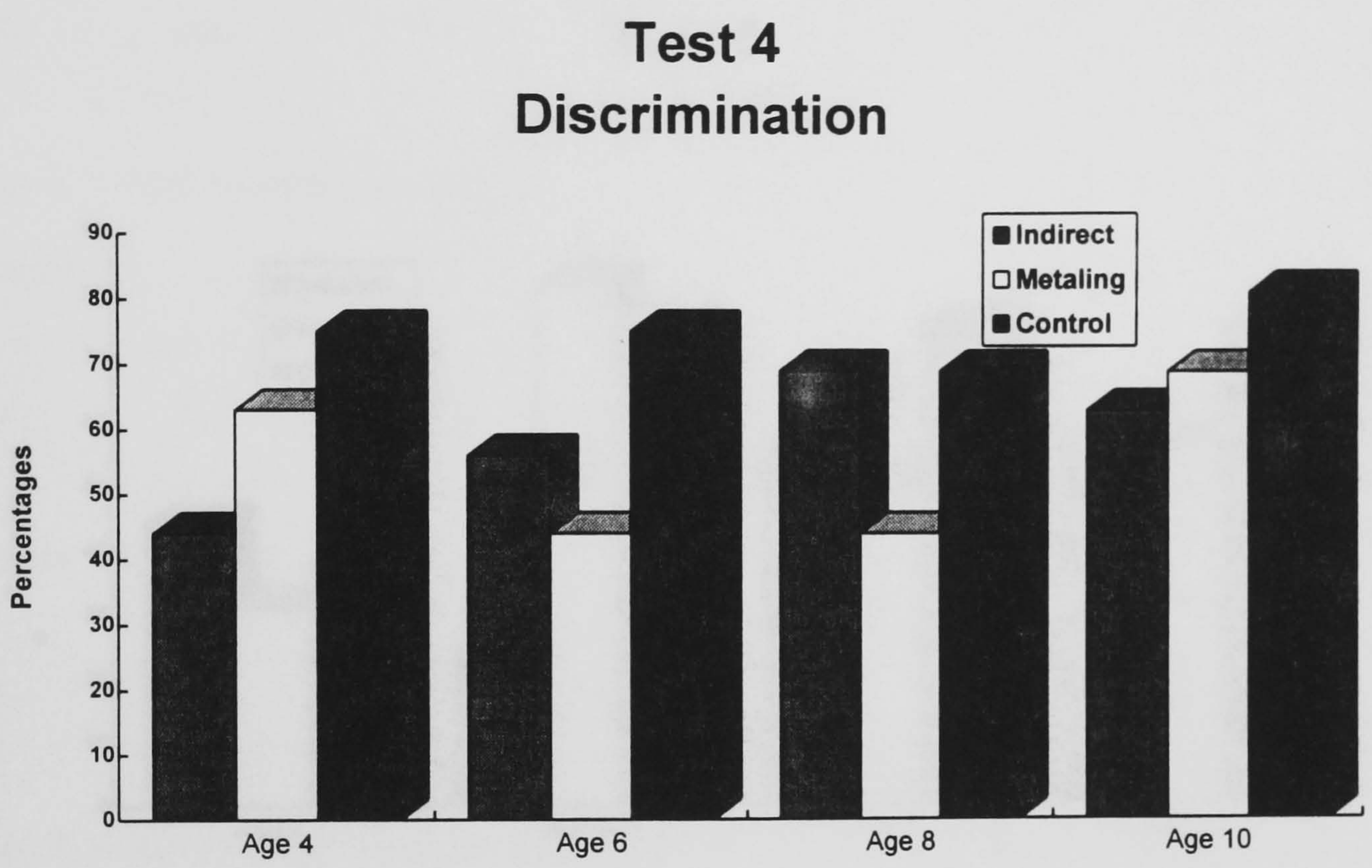

Figure B.3.

Percentages of Correct Responses for Age and Condition.

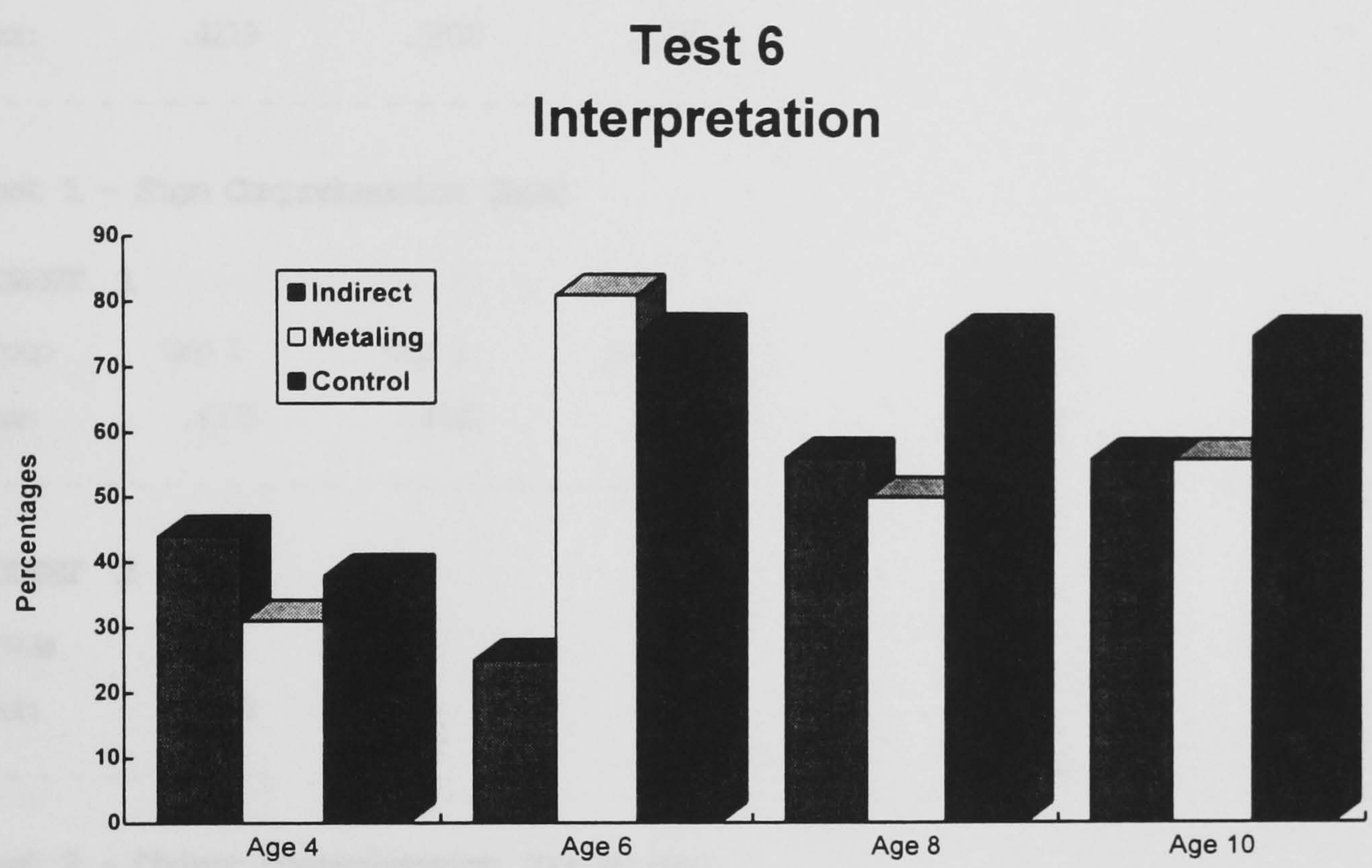

Table B.2.

Duncan Multiple Range Test for Age and Condition in Experiment 2

THE SUBSETS

No two groups are significantly different at the .050 level

Test 1 - Sign Comprehension (Condition)

SUBSET 1

Group	Grp 2	Grp 1	Grp 3
Mean	.4219	.5938	.5938

Test 1 - Sign Comprehension (Age)

SUBSET 1

Group	Grp 1	Grp 3	Grp 2
Mean	.4375	.4792	.5000

SUBSET 2

Group	Grp 4
Mean	.7292

Test 2 - Object Comprehension (Condition)

SUBSET 1

Group	Grp 2	Grp 3
Mean	.5938	.6563

SUBSET 2

Group	Grp 3	Grp 1
Mean	.6563	.8125

Test 2 - Object Comprehension (Age)

SUBSET 1

Group	Grp 1	Grp 3	Grp 2
Mean	.5833	.6458	.7083

Test 3 - Production (Condition)

SUBSET 1

Group	Grp 1	Grp 3	Grp 2

Mean	.2656	.3281	.3438

Test 3 - Production (Age)

SUBSET 1

Group	Grp 1	Grp 2	Grp 3
Mean	.2083	.2292	.2708

SUBSET 2

Group	Grp 4
Mean	.5417

Test 4 - Production (Condition)

SUBSET 1

Group	Grp 2	Grp 3
Mean	.5469	.5781

SUBSET 2

Group	Grp 1
Mean	.7500

Test 4 - Discrimination (Age)

SUBSET 1

Group	Grp 2	Grp 1	Grp 3	Grp 4
Mean	.5833	.6042	.6042	.7083

Test 5 - Depiction (Condition)

SUBSET 1

Group	Grp 3	Grp 2	Grp 1
Mean	.5938	.6250	.7500

Test 5 - Depiction (Age)

SUBSET 1

Group	Grp 1	Grp 3	Grp 2
Mean	.5208	.6458	.7083

SUBSET 2

Group	Grp 3	Grp 2	Grp 4
Mean	.6458	.7083	.7500

\- -

Test 6 - Interpretation (Condition)

SUBSET 1

Group	Grp 3	Grp 2
Mean	.4219	.4844

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SUBSET 2

Group	Grp 2	Grp 1
Mean	.4844	.6563

\- - - - - - - - - - - - - - - - -

SUBSET 2

Group	Grp 3	Grp 2	Grp 4
Mean	.6458	.7083	.8125

\- -

Test 6 - Interpretation (Age)

SUBSET 1

Group	Grp 1	Grp 2	Grp 4
Mean	.3750	.5208	.5833

\- -

SUBSET 2

Group	Grp 2	Grp 4	Grp 3
Mean	.5208	.5833	.6042

\- -

Table B.3.

Correlation Matrix with STD for the Tests in the Test Phase in Experiment 2

Variable	Cases	Mean	Std Dev
SICOM	192	.5365	.5000
OBCOM	192	.6875	.4647
PROD	192	.3125	.4647
DISC	192	.6250	.4854
DEPIC	192	.6563	.4762
INTER	192	.5208	.5009

Correlations:	SICOM	OBCOM	PROD	DISC	DEPIC	INTER
SICOM	1.0000	.4324**	.4014**	.3371**	.3388**	.2374**
OBCOM	.4324**	1.0000	.2848**	.2437**	.3874**	.2306*
PROD	.4014**	.2848**	1.0000	.2205*	.3223**	.2868**
DISC	.3371**	.2437**	.2205*	1.0000	.5493**	.3338**
DEPIC	.3388**	.3874**	.3223**	.5493**	1.0000	.6668**
INTER	.2374**	.2306*	.2868**	.3338**	.6668**	1.0000

N of cases: 192 2-tailed Signif: * - .01 ** - .001

Effects of Age and Condition on Performance in Posttesting.

Posttest 1 (Symbol Comprehension 2)

Two way Anova shows significant main effects of Age $F(3,180) = 4.97$, $p<.005$. Age group 10.5 performed best overall. The Control condition gave the best results in all agegroups except age group 8.5, where the Indirect condition did.

Posttest 2 (Picture Comprehension)

Two way Anova shows significant main effects of Condition $F(2,180) = 3.89$, $p<.05$. Age group 10.5 performed best overall. The Control condition gave the best results in all age groups except age group 10.5, where the Indirect condition did.

Posttest 3 (Production Post)

Two way Anova shows significant main effects of Age $F(3,180) = 3.78$, $p<.05$. Age group 10.5 performed best overall. The Control condition gave the best results in age groups 6.5 and 8.5, the Indirect condition in age group 4.5 and the Metalinguistic condition in age group 10.5.

Posttest 4 (Production List)

Two way Anova shows significant main effects of Age $F(3,180) = 3.71$, $p<.05$. Age group 10.5 performed best overall. The Control condition gave the best results in age groups 6.5 and 8.5, the Indirect condition in age group 4.5 and the Metalinguistic condition in age group 10.5.

Posttest 5 (Generalisation)

Two way Anova shows significant main effects of Age $F(3,180) = 4.02$, $p<.01$ and of Condition $F(2,180) = 3.44$, $p=.05$.

Table B.4.

Summary Table for Two-way Anovas for all Tests in Experiment 2

	SICOM	SYMBOL COMPREHENSION
BY	AGROUP	AGE GROUPS
	COND	CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	3.734	5	.747	3.104	.010
AGROUP	2.474	3	.825	3.427	.018
COND	1.260	2	.630	2.619	.076
2-way Interactions	.698	6	.116	.483	.820
AGROUP COND	.698	6	.116	.483	.820
Explained	4.432	11	.403	1.675	.082
Residual	43.312	180	.241		
Total	47.745	191	.250		

	OBCOM	OBJECT COMPREHENSION
BY	AGROUP	AGE GROUPS
	COND	CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	3.000	5	.600	2.851	.017
AGROUP	1.375	3	.458	2.178	.092
COND	1.625	2	.812	3.861	.023
2-way Interactions	.375	6	.063	.297	.938
AGROUP COND	.375	6	.063	.297	.938
Explained	3.375	11	.307	1.458	.151
Residual	37.875	180	.210		
Total	41.250	191	.216		

	PROD	PRODUCTION
BY	AGROUP	AGE GROUPS
	COND	CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	3.677	5	.735	3.590	.004
AGROUP	3.458	3	1.153	5.627	.001
COND	.219	2	.109	.534	.587
2-way Interactions	.698	6	.116	.568	.756
AGROUP COND	.698	6	.116	.568	.756
Explained	4.375	11	.398	1.941	.037
Residual	36.875	180	.205		
Total	41.250	191	.216		

	DISC	DISCRIMINATION
BY	AGROUP	AGE GROUPS
	COND	CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	1.990	5	.398	1.705	.136
AGROUP	.458	3	.153	.655	.581
COND	1.531	2	.766	3.281	.040
2-way Interactions	1.010	6	.168	.722	.633
AGROUP COND	1.010	6	.168	.722	.633
Explained	3.000	11	.273	1.169	.312
Residual	42.000	180	.233		
Total	45.000	191	.236		

DEPIC DEPICTION
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	2.313	5	.463	2.062	.072
AGROUP	1.438	3	.479	2.136	.097
COND	.875	2	.438	1.950	.145
2-way Interactions	.625	6	.104	.464	.834
AGROUP COND	.625	6	.104	.464	.834
Explained	2.938	11	.267	1.191	.296
Residual	40.375	180	.224		
Total	43.313	191	.227		

INTER INTERPRETATION
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	3.427	5	.685	2.878	.016
AGROUP	1.542	3	.514	2.157	.095
COND	1.885	2	.943	3.958	.021
2-way Interactions	1.615	6	.269	1.130	.347
AGROUP COND	1.615	6	.269	1.130	.347
Explained	5.042	11	.458	1.924	.039
Residual	42.875	180	.238		
Total	47.917	191	.251		

Full Meaning (Combined tests T1 - T6)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	72.057	5	14.411	3.934	.002
AGROUP	48.266	3	16.089	4.392	.005
COND	23.792	2	11.896	3.247	.041
2-way Interactions	3.500	6	.583	.159	.987
AGROUP COND	3.500	6	.583	.159	.987
Explained	75.557	11	6.869	1.875	.045
Residual	659.438	180	3.664		
Total	734.995	191	3.848		

Comprehension (Combined tests T1+T2+T3+T5+T6)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	55.839	5	11.168	3.994	.002
AGROUP	27.266	3	9.089	3.250	.023
COND	28.573	2	14.286	5.109	.007
2-way Interactions	3.719	6	.620	.222	.969
AGROUP COND	3.719	6	.620	.222	.969
Explained	59.557	11	5.414	1.936	.037
Residual	503.313	180	2.796		
Total	562.870	191	2.947		

INSIGHT (Combined tests T5+T6)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	10.677	5	2.135	2.785	.019
AGROUP	5.354	3	1.785	2.328	.076
COND	5.323	2	2.661	3.471	.033
2-way Interactions	3.302	6	.550	.718	.636
AGROUP COND	3.302	6	.550	.718	.636
Explained	13.979	11	1.271	1.658	.086
Residual	138.000	180	.767		
Total	151.979	191	.796		

SICOM2 POSTTEST 1 (SYMBOL COMPREHENSION POST)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	4.172	5	.834	3.539	.004
AGROUP	3.516	3	1.172	4.971	.002
COND	.656	2	.328	1.392	.251
2-way Interactions	.969	6	.161	.685	.662
AGROUP COND	.969	6	.161	.685	.662
Explained	5.141	11	.467	1.982	.032
Residual	42.438	180	.236		
Total	47.578	191	.249		

PICOM POSTTEST 2 (PICTURE COMPREHENSION)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	2.776	5	.555	2.456	.035
AGROUP	1.016	3	.339	1.498	.217
COND	1.760	2	.880	3.894	.022
2-way Interactions	1.281	6	.214	.945	.464
AGROUP COND	1.281	6	.214	.945	.464
Explained	4.057	11	.369	1.632	.093
Residual	40.688	180	.226		
Total	44.745	191	.234		

PROD2 POSTTEST 3 (PRODUCTION 2)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	2.802	5	.560	2.346	.043
AGROUP	2.708	3	.903	3.779	.012
COND	.094	2	.047	.196	.822
2-way Interactions	1.448	6	.241	1.010	.420
AGROUP COND	1.448	6	.241	1.010	.420
Explained	4.250	11	.386	1.617	.097
Residual	43.000	180	.239		
Total	47.250	191	.247		

PROLI POSTTEST 4 (PRODUCTION POST LIST)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	3.010	5	.602	2.550	.029
AGROUP	2.625	3	.875	3.706	.013

COND	.385	2	.193	.816	.444
2-way Interactions	2.156	6	.359	1.522	.173
AGROUP COND	2.156	6	.359	1.522	.173
Explained	5.167	11	.470	1.989	.032
Residual	42.500	180	.236		
Total	47.667	191	.250		

GENER POSTTEST 5 (GENERALIZATION)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	3.557	5	.711	3.787	.003
AGROUP	2.266	3	.755	4.020	.008
COND	1.292	2	.646	3.438	.034
2-way Interactions	1.000	6	.167	.887	.505
AGROUP COND	1.000	6	.167	.887	.505
Explained	4.557	11	.414	2.206	.016
Residual	33.813	180	.188		
Total	38.370	191	.201		

POST (Combined posttests SICOM2 - GENER)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	63.422	5	12.684	4.492	.001
AGROUP	48.599	3	16.200	5.737	.001
COND	14.823	2	7.411	2.624	.075
2-way Interactions	13.635	6	2.273	.805	.567
AGROUP COND	13.635	6	2.273	.805	.567
Explained	77.057	11	7.005	2.481	.006
Residual	508.313	180	2.824		
Total	585.370	191	3.065		

POSTc (Combined posttests SICOM2+PICOM)
BY COND CONDITION
AGROUP AGE GROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	11.729	5	2.346	3.530	.005
COND	4.542	2	2.271	3.417	.035
AGROUP	7.188	3	2.396	3.605	.015
2-way Interactions	2.625	6	.438	.658	.683
COND AGROUP	2.625	6	.438	.658	.683
Explained	14.354	11	1.305	1.964	.034
Residual	119.625	180	.665		
Total	133.979	191	.701		

POSTCOM (Combined posttests SICOM2+PICOM+PROLIST+GENER)
BY COND CONDITION
AGROUP AGE GROUPS

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	22.302	5	4.460	3.294	.007
COND	5.698	2	2.849	2.104	.125
AGROUP	16.604	3	5.535	4.087	.008
2-way Interactions	4.927	6	.821	.606	.725
COND AGROUP	4.927	6	.821	.606	.725
Explained	27.229	11	2.475	1.828	.052
Residual	243.750	180	1.354		
Total	270.979	191	1.419		

Total cases = 192

Table B.5.

Summary Table Showing Means for all Tests in Experiment 2

Condition	*Group 1* Mean / Std. Dev. / Cases	*Group 2* Mean / Std. Dev. / Cases	*Group 3* Mean / Std. Dev. / Cases	*Group 4* Mean / Std. Dev. / Cases
Summaries of Symbol Comprehension by levels of Conditions and Agegroups.				
	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	0,4375 0,5123 16	0,6250 0,5000 16	0,5000 0,5164 16	0,8125 0,4031 16
Metalinguistic	0,3750 0,5000 16	0,3750 0,5000 16	0,4375 0,5123 16	0,5000 0,5164 16
Indirect	0,5000 0,5164 16	0,5000 0,5164 16	0,5000 0,5164 16	0,8750 0,3416 16
Summaries of Object Comprehension by levels of Conditions and Agegroups.				
	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	0,6875 0,4787 16	0,8125 0,4031 16	0,7500 0,4472 16	1,0000 0,0000 16
Metalinguistic	0,5625 0,5123 16	0,5625 0,5123 16	0,5625 0,5123 16	0,6875 0,4787 16
Indirect	0,5000 0,5164 16	0,7500 0,4472 16	0,6250 0,5000 16	0,7500 0,4472 16
Summaries of Production by levels of Conditions and Agegroups.				
	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	0,1250 0,3416 16	0,1875 0,4031 16	0,2500 0,4472 16	0,5000 0,5164 16
Metalinguistic	0,3125 0,4787 16	0,1875 0,4031 16	0,3750 0,5000 16	0,5000 0,5164 16
Indirect	0,1875 0,4031 16	0,3125 0,4787 16	0,1875 0,4031 16	0,6250 0,5000 16

Summaries of Discrimination by levels of Conditions and Agegroups.

	4,5 yrs	6,5 yrs	8,5 yrs	10,5 yrs
	0,7500	0,7500	0,6875	0,8125
Control	0,4472	0,4472	0,4787	0,4031
	16	16	16	16
	0,6250	0,4375	0,4375	0,6875
Metalinguistic	0,5000	0,5123	0,5123	0,4787
	16	16	16	16
	0,4375	0,5625	0,6875	0,6250
Indirect	0,5123	0,5123	0,4787	0,5000
	16	16	16	16

Summaries of Depiction by levels of Conditions and Agegroups.

	4,5 yrs	6,5 yrs	8,5 yrs	10,5 yrs
	0,6250	0,8750	0,7500	0,7500
Control	0,5000	0,3416	0,4472	0,4472
	16	16	16	16
	0,4375	0,6875	0,5625	0,8125
Metalinguistic	0,5123	0,4787	0,5123	0,4031
	16	16	16	16
	0,5000	0,5625	0,6250	0,6875
Indirect	0,5164	0,5123	0,5000	0,4787
	16	16	16	16

Summaries of Interpretation by levels of Conditions and Agegroups.

	4,5 yrs	6,5 yrs	8,5 yrs	10,5 yrs
	0,3750	0,7500	0,7500	0,7500
Control	0,5000	0,4472	0,4472	0,4472
	16	16	16	16
	0,3125	0,5625	0,5000	0,5625
Metalinguistic	0,4787	0,5123	0,5164	0,5123
	16	16	16	16
	0,4375	0,2500	0,5625	0,4375
Indirect	0,5123	0,4472	0,5123	0,5123
	16	16	16	16

Summaries of Full Meaning (Combined tests T1-T6) by levels of Conditions and Agegroups.

	4,5 yrs	6,5 yrs	8,5 yrs	10,5 yrs
	3,0000	4,0000	3,6875	4,6250
Control	1,8619	1,5055	1,6215	1,7842
	16	16	16	16
	2,6250	2,8125	2,8750	3,7500
Metalinguistic	1.8212	2,0073	2.3629	2,2061
	16	16	16	16

	4,5 yrs	6,5 yrs	8,5 yrs	10,5 yrs
Indirect	2,5625 1,8963 16	2,9375 1,7689 16	3,1875 2,0726 16	4,0000 1,8974 16

Summaries of Comprehension (Combined tests T1+T2+T4+T5+T6) by levels of Conditions and Agegroups.

	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	2,8750 1,7078 16	3,8125 1,3276 16	3,4375 1,5478 16	4,1250 1,4549 16
Metalinguistic	2,3125 1,5798 16	2,6250 1,8212 16	2,5000 2,0000 16	3,2500 1,7701 16
Indirect	2,3750 1,6279 16	2,6250 1,6683 16	3,0000 1,8974 16	3,3750 1,5438 16

Summaries of Insight (Combined tests T5+T6) by levels of Conditions and Agegroups.

	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	1,0000 0,8944 16	1,6250 0,7188 16	1,5000 0,8165 16	1,5000 0,8165 16
Metalinguistic	0,7500 0,9309 16	1,2500 0,9309 16	1,0625 0,9287 16	1,3750 0,8062 16
Indirect	0,9375 0,9979 16	0,8125 0,8342 16	1,1875 0,9106 16	1,1250 0,8851 16

Summaries of Symbol Comprehension Post (Posttest 1) by levels of Conditions and Agegroups.

	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	0,5625 0,5123 16	0,6875 0,4787 16	0,4375 0,5123 16	0,8125 0,4031 16
Metalinguistic	0,4375 0,5123 16	0,5625 0,5123 16	0,1875 0,4031 16	0,7500 0,4472 16
Indirect	0,5000 0,5164 16	0,4375 0,5123 16	0,5000 0,5164 16	0,6875 0,4787 16

Summaries of Picture Comprehension (Posttest 2) by levels of Conditions and Agegroups.

	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	0,7500 0,4472 16	0,8125 0,4031 16	0,7500 0,4472 16	0,6875 0,4787 16
Metalinguistic	0,4375 0,5123 16	0,4375 0,5123 16	0,5000 0,5164 16	0,6875 0,4787 16
Indirect	0,5000 0,5164 16	0,5000 0,5164 16	0,6250 0,5000 16	0,8750 0,3416 16

Summaries of Production Post (Posttest 3) by levels of Conditions and Agegroups.

	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	0,3125 0,4787 16	0,6250 0,5000 16	0,7500 0,4472 16	0,6250 0,5000 16
Metalinguistic	0,3750 0,5000 16	0,4375 0,5123 16	0,5000 0,5164 16	0,8125 0,4031 16
Indirect	0,5000 0,5164 16	0,5625 0,5123 16	0,5000 0,5164 16	0,7500 0,4472 16

Summaries of Generalization (Posttest 4) by levels of Conditions and Agegroups.

	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	0,3125 0,4787 16	0,3125 0,4787 16	0,4375 0,5123 16	0,5000 0,5164 16
Metalinguistic	0,0625 0,2500 16	0,0625 0,2500 16	0,3750 0,5000 16	0,3125 0,4787 16
Indirect	0,1875 0,4031 16	0,1250 0,3416 16	0,1250 0,3416 16	0,5000 0,5164 16

Summaries of Production Post List (Posttest 5) by levels of Conditions and Agegroups.

	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	0,3750 0,5000 16	0,6250 0,5000 16	0,7500 0,4472 16	0,6250 0,5000 16

Metalinguistic	0,3750 0,5000 16	0,5000 0,5164 16	0,4375 0,5123 16	0,8750 0,3416 16
Indirect	0,5000 0,5164 16	0,3125 0,4787 16	0,4375 0,5123 16	0,6875 0,4787 16

Summaries of Post (Combined posttests 1+5) by levels of Conditions and Agegroups.

	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	2,3125 1,6215 16	3,0625 1,8062 16	3,1250 1,7464 16	3,2500 1,8439 16
Metalinguistic	1,6875 1,8154 16	2,0000 1,7125 16	2,0000 1,8619 16	3,4375 1,1529 16
Indirect	2,1875 1,7595 16	1,9375 1,5692 16	2,1875 1,6008 16	3,5000 1,5492 16

Summaries of Post Comprehension (Combined posttests 1+2) by levels of Conditions and Agegroups.

	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	1,3125 0,7042 16	1,5000 0,8165 16	1,1875 0,8342 16	1,5000 0,8165 16
Metalinguistic	0,8750 0,8062 16	1,0000 0,8944 16	0,6875 0,7932 16	1,4375 0,8139 16
Indirect	1,0000 0,8944 16	0,9375 0,8539 16	1,1250 0,8851 16	1,5625 0,6292 16

Summaries of Post Comprehension (Combined posttests 1+2+3) by levels of Conditions and Agegroups.

	4,5 yrs	*6,5 yrs*	*8,5 yrs*	*10,5 yrs*
Control	1,6250 1,0247 16	2,1250 1,2583 16	1,9375 1,1815 16	2,1250 1,1475 16
Metalinguistic	1,2500 1,2383 16	1,4375 1,2633 16	1,1875 1,1673 16	2,2500 1,0646 16

Indirect	1,5000 1,2649 16	1,5000 1,2649 16	1,6250 1,1475 16	2,3125 0,8732 16

Total cases = 192

APPENDIX C
EXPERIMENT 3

The Story Used in the Encoding phase.
Nandi of Wild Wood.

Section 1.

Across the magic meadow by the silvery stream, Wild Wood opens onto a chain of lofty mountains. The trees of Wild Wood are very, very tall. Up and up they tower. But down on the ground among the evergreen bushes and multicoloured flowers, the bright-eyed pixie, Nandi, makes his swift ways. Swifter than a mouse even.

Nandi is a busy fellow. In Spring and Summer, for example, he has the job of polishing gently the petal coats of Wild Wood's flowers so that they may twinkle like stars when the sun comes out to play.

Autumn has now fallen, however, and many of the flowers droop their pretty heads silently. Nandi has been given a new job. This time it is picking tasty mushrooms for the Fairy Queen's Autumn Party. Some of the mushrooms have gone mouldy. Nandi takes care not to pick those. "Some mimbos have been in these mushrooms already, "he cries out somewhat annoyed. Well, the mimbos can only move slowly while I can run. I should be able to get to more mushrooms than they can," he then adds and brightens up at the thought.

Section 2.

Up, up, the trees of Wild Wood tower. A new day has broken and in the cool morning breeze some gleaming gombes dingle dangle merrily on their hedge. Nandi is not too merry, though. He has a secret worry, the poor soul. Here on the hedge top, the roof of his house, because, you see, he lives in that hedge, he now sits and washes his face from the morning dew. This is the day before the Fairy Queen's Autumn Party. All the pixies are going, but Nandi is still not sure if he will go.

"Oh me, oh my," he sighs as his eyes meet their own reflection in a big dew drop, "why was I made so different from all the other pixies, oh dear, oh dear, one eye brown and one eye blue, oh the shame, at least I thought they would both have turned brown as I grew older, brown like the eyes of the other pixies, but, alas, no, here I am still with one eye brown and one eye blue, deary me." And like he has done so often before when feeling so blue, he reaches out for his magic wand and waves it in front of his eyes and utters the pixies' magic words: "Ixy, Wixy". He looks back into the dew drop. No, it didn't work this time either.

"Oh, Nandi. Stop being so silly," he says in a bleak tone of voice, and let's himself slip to the ground. Then he steps on something soft and long which nearly gets squashed. "Oh, it is a mimbo. So sorry," he says softly. Then he rushes off for his day's work.

Section 3.

Up, up the trees of Wild Wood tower. The noblest of them is the mighty, old Oak, home of Wise Elf.

Now, Wise Elf is said to be of a cross temper, but cross, or not, he knows all about magic, and a little magic, Nandi feels is badly needed to change the colour of his blue eye. After all, it is quite clear that Nandi's own magic wand won't do the job. Nandi, therefore, decides to pay Wise Elf a visit.

Hidden behind a spray of ivy is a tiny door to the old Oak. A lone bird sits there and digs for blue mimbos. His favourites. Nandi knocks loudly on the door which creeks open. Two twinkling brown eyes look him up and down and a gruff voice says: "Speak up, pixie. Don't waste my time." These sharp words startle Nandi, but he plucks up his courage and stammers: "Well, uhm, it's my eyes, I have got one brown and one blue, and it feels dreadfully odd, all other pixies I know of have got both theirs brown. I wondered if you...?" "You young fool," Wise Elf interrupts with a mischievous look on his face," it's your Irises, and my magic can't change them, anyway. Just let it be and your Irises shall take you to the Source of Light." Saying that, he roars with laughter, as if it is all a big joke, and slams the door. What cheek .

As Nandi turns from the door, he sees that lone bird again, but this time with a blue mimbo in his beak.

Section 4.

"Oh me, oh my," Nandi whispers helplessly, as he slips back home. "I am afraid I don't understand at all what Wise Elf is talking about." It feels as if his good heart is sinking. I mean to say, he has a really bad heart ache, as you can imagine. For many hours he racks his brain over Wise Elf's words. It is this word Iris that puzzles him most. Wise Elf had said he could not change "your Irises." And he had also said something about the source of Light.

Now, Nandi knows some things that bear the name Iris. Well, one is the rainbow. Everyone in Wild Wood calls her Iris. Her flight through the air is so rapid that she is seldom seen, except for her multicoloured shiny trail. Even though Nandi has sometimes seen two such Irises in the sky, surely they are not the Irises Wise Elf meant. After all, they do not belong to him. "Your Irises," must therefore be something different. Well, on the bank of the silvery stream where the mimbos live in the damp, dark soil, there are the Yellow Irises, the flowers that grow by the stream. But, another pixie takes care of these flowers, so it can not be them either. But then what can "my Irises" be ?

Poor Nandi is hungry and completely exhausted. He picks a few juicy gombes from his hedge to eat. Then he falls asleep. He dreams that the Fairy Queen comes to him. She looks him in the eyes and whispers softly : "Remember Iris, the rainbow. She has got a visible part and an invisible part. Well, dear chap, that's how it is with the most important things. They are invisible to the eyes. But the source of Light where all things come from also shines in you. Why bother so much then over having a brown Iris in one eye and a blue Iris in the other? After all, it is your Irises that help the Light make some things visible to you." Saying this she disappears and Nandi wakes . His worry has left him and he sings sweetly at the top of his tiny voice and happiness shines in his eyes. Now he knows what Wise Elf meant about his Irises. But he just doesn't know how to tell it yet.

Quantitative Data.

In the following pages quantitative data are presented that compliment the data presented in the Result section of Chapter 4 (p. 240-255).

Patterns of Within-Children/Between-Children Responses.

In the 4-year-old group for Indirects, two of the children got all five tests correct and three children had all tests correct when the scores from Test 3 (Production) were omitted. In the same age group for Controls, two of the children got all five tests correct and two children had all tests correct when T3 was omitted.

In the 5-year-old age group for Indirects, two of the children got all five tests correct and three children had all tests correct when the first test had been omitted, and one child had all tests correct when T3 is omitted. In the same age group for Controls, seven of the children got all five tests correct and two children had all tests correct when T3 is omitted.

Table C.1.

Percentages of Correct Responses in T3, T4 and T5 in the Test Phase in Exp. 3.

Age	*Condition*	*T3*	*T4*	*T5*
4	Indirect	22%	50%	50%
4	Control	33%	50%	61%
5	Indirect	39%	72%	56%
5	Control	50%	67%	72%

Figure C.1.

Percentages of Correct Responses for Age and Condition.

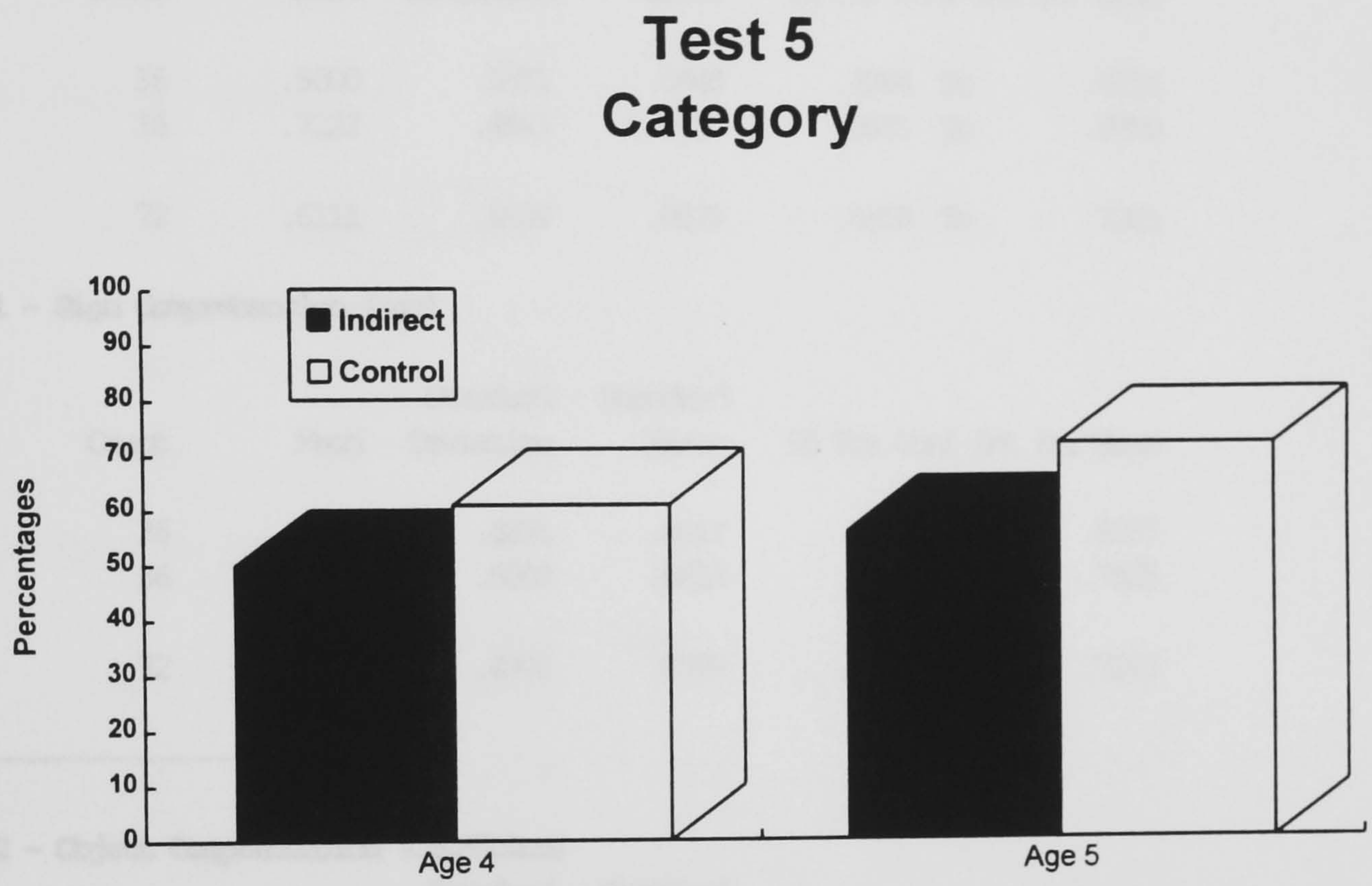

Table C.2.

Duncan Multiple Ranges Test for Age and Condition in Experiment 3.

(No subsets are presented here, as there were not significant enough differences in means: differences in means are presented in the following table).

Test 1 - Sign Comprehension (Condition)

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	36	.5000	.5071	.0845	.3284	To	.6716
Grp 2	36	.7222	.4543	.0757	.5685	To	.8759
Total	72	.6111	.4909	.0579	.4958	To	.7265

Test 1 - Sign Comprehension (Age)

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	36	.6389	.4871	.0812	.4741	To	.8037
Grp 2	36	.5833	.5000	.0833	.4142	To	.7525
Total	72	.6111	.4909	.0579	.4958	To	.7265

Test 2 - Object Comprehension (Condition)

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	36	.6111	.4944	.0824	.4438	To	.7784
Grp 2	36	.6667	.4781	.0797	.5049	To	.8284
Total	72	.6389	.4837	.0570	.5252	To	.7526

Test 2 - Object Comprehension (Age)

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	36	.6944	.4672	.0779	.5364	To	.8525
Grp 2	36	.5833	.5000	.0833	.4142	To	.7525
Total	72	.6389	.4837	.0570	.5252	To	.7526

Test 3 - Production (Condition)

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	36	.3056	.4672	.0779	.1475	To	.4636
Grp 2	36	.4167	.5000	.0833	.2475	To	.5858

Total	72	.3611	.4837	.0570	.2474	To	.4748

Test 3 - Production (Age)

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	36	.2778	.4543	.0757	.1241	To	.4315
Grp 2	36	.4444	.5040	.0840	.2739	To	.6150
Total	72	.3611	.4837	.0570	.2474	To	.4748

Test 4 - Depiction (Condition)

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	36	.6389	.4871	.0812	.4741	To	.8037
Grp 2	36	.5833	.5000	.0833	.4142	To	.7525
Total	72	.6111	.4909	.0579	.4958	To	.7265

Test 4 - Depiction (Age)

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	36	.5278	.5063	.0844	.3565	To	.6991
Grp 2	36	.6944	.4672	.0779	.5364	To	.8525
Total	72	.6111	.4909	.0579	.4958	To	.7265

Test 5 - Category (Condition)

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	36	.5278	.5063	.0844	.3565	To	.6991
Grp 2	36	.6667	.4781	.0797	.5049	To	.8284
Total	72	.5972	.4939	.0582	.4812	To	.7133

Test 5 - Category (Age)

Group	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
Grp 1	36	.5556	.5040	.0840	.3850	To	.7261
Grp 2	36	.6389	.4871	.0812	.4741	To	.8037
Total	72	.5972	.4939	.0582	.4812	To	.7133

Table C.3.

Correlation Matrix with STD for the Tests in the Test Phase in Experiment 3.

Variable	Cases	Mean	Std Dev
SICOM	72	.6111	.4909
OBCOM	72	.6389	.4837
PROD	72	.3611	.4837
DEPIC	72	.6111	.4909
CATEG	72	.5972	.4939

Correlations:	SICOM	OBCOM	PROD	DEPIC	CATEG
SICOM	1.0000	.5272**	.1252	.1234	.2743
OBCOM	.5272**	1.0000	.3244*	.2307	.2080
PROD	.1252	.3244*	1.0000	.3032*	.3226*
DEPIC	.1234	.2307	.3032*	1.0000	.5648**
CATEG	.2743	.2080	.3226*	.5648**	1.0000

N of cases: 72 2-tailed Signif: * - .01 ** - .001

Effects of Age and Condition on Performance in the first two Tests of the Test Phase and of all the Tests in Posttesting.

Test 1 (Sign Comprehension).

Two way Anova shows that Condition is close to being significant $F(1,68) = 3.75$ almost at $p=.05$. Age group 4.4 performed better overall, with the Control condition giving better results for both age groups.

Test 2 (Object Comprehension).

Two way Anova shows no significant main effects of Age and Condition. Age group 4.4 performed better overall. The Control condition gave better results with age group 4.4, the Indirect condition with age group 5.6.

Posttests:

Posttest 1 (Sign Comprehension Post).

Two way Anova shows no significant main effects of Age and Condition. Age group 4.4 performed better overall. The Control condition gives better results in age group 4.4, the Indirect condition in age group 5.6.

Posttest 2 (Object Comprehension Post)..

Two way Anova shows no significant main effects of Age and Condition. Age group 5.6 performed better overall. The Control condition gives better results in both agegroups.

Posttest 3 (Production Post).

Two way Anova shows no significant main effects of Age and Condition. Age group 5.6 performed better overall. The Control condition gives better results in both age groups.

Posttest 4 (Category Post).

Two way Anova shows no significant main effects of Age and Condition. Age group 5.6 performed better overall. The Control condition gives better results in age group 4.4, but both the Control condition and the Indirect condition give the same results in age group 5.6.

Table C.4.

Summary Table for Two-way Anovas for all Tests in Experiment 3

	SICOM	SIGN COMPREHENSION
BY	AGROUP	AGE GROUPS
	COND	CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.944	2	.472	1.993	.144
AGROUP	.056	1	.056	.234	.630
COND	.889	1	.889	3.752	.057
2-way Interactions	.056	1	.056	.234	.630
AGROUP COND	.056	1	.056	.234	.630
Explained	1.000	3	.333	1.407	.248
Residual	16.111	68	.237		
Total	17.111	71	.241		

	OBCOM	OBJECT COMPREHENSION
BY	AGROUP	AGE GROUPS
	COND	CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.278	2	.139	.586	.559
AGROUP	.222	1	.222	.938	.336
COND	.056	1	.056	.234	.630
2-way Interactions	.222	1	.222	.938	.336
AGROUP COND	.222	1	.222	.938	.336
Explained	.500	3	.167	.703	.553
Residual	16.111	68	.237		
Total	16.611	71	.234		

	PROD	PRODUCTION
BY	AGROUP	AGE GROUPS
	COND	CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.722	2	.361	1.545	.221
AGROUP	.500	1	.500	2.140	.148
COND	.222	1	.222	.951	.333
2-way Interactions	.000	1	.000	.000	1.000
AGROUP COND	.000	1	.000	.000	1.000
Explained	.722	3	.241	1.030	.385
Residual	15.889	68	.234		
Total	16.611	71	.234		

	DEPIC	DEPICTION
BY	AGROUP	AGE GROUPS
	COND	CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.556	2	.278	1.141	.326
AGROUP	.500	1	.500	2.054	.156
COND	.056	1	.056	.228	.634
2-way Interactions	.000	1	.000	.000	1.000
AGROUP COND	.000	1	.000	.000	1.000
Explained	.556	3	.185	.761	.520
Residual	16.556	68	.243		
Total	17.111	71	.241		

CATEG CATEGORY
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.472	2	.236	.954	.390
AGROUP	.125	1	.125	.505	.480
COND	.347	1	.347	1.403	.240
2-way Interactions	.014	1	.014	.056	.813
AGROUP COND	.014	1	.014	.056	.813
Explained	.486	3	.162	.655	.583
Residual	16.833	68	.248		
Total	17.319	71	.244		

Full Meaning (Combined tests T1 - T5)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	5.139	2	2.569	.966	.386
AGROUP	1.125	1	1.125	.423	.518
COND	4.014	1	4.014	1.509	.223
2-way Interactions	.681	1	.681	.256	.615
AGROUP COND	.681	1	.681	.256	.615
Explained	5.819	3	1.940	.729	.538
Residual	180.833	68	2.659		
Total	186.653	71	2.629		

Comp (Combined tests T1+T2+T4+T5)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	2.472	2	1.236	.643	.529
AGROUP	.125	1	.125	.065	.799
COND	2.347	1	2.347	1.221	.273
2-way Interactions	.681	1	.681	.354	.554
AGROUP COND	.681	1	.681	.354	.554
Explained	3.153	3	1.051	.547	.652
Residual	130.722	68	1.922		
Total	133.875	71	1.886		

Verbal concept (Combined tests T1+T2+T5)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	3.250	2	1.625	1.358	.264
AGROUP	.125	1	.125	.104	.748
COND	3.125	1	3.125	2.611	.111
2-way Interactions	.681	1	.681	.569	.453
AGROUP COND	.681	1	.681	.569	.453
Explained	3.931	3	1.310	1.095	.357
Residual	81.389	68	1.197		
Total	85.319	71	1.202		

SICOM2 SIGN COMPREHENSION POST
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.056	2	.028	.132	.877
AGROUP	.056	1	.056	.264	.609
COND	.000	1	.000	.000	1.000
2-way Interactions	.056	1	.056	.264	.609
AGROUP COND	.056	1	.056	.264	.609
Explained	.111	3	.037	.176	.912
Residual	14.333	68	.211		
Total	14.444	71	.203		

OBCOM2 OBJECT COMPREHENSION.POST
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.806	2	.403	1.949	.150
AGROUP	.125	1	.125	.605	.439
COND	.681	1	.681	3.292	.074
2-way Interactions	.014	1	.014	.067	.796
AGROUP COND	.014	1	.014	.067	.796
Explained	.819	3	.273	1.321	.275
Residual	14.056	68	.207		
Total	14.875	71	.210		

PROD2 PRODUCTION POST
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.722	2	.361	1.426	.247
AGROUP	.500	1	.500	1.974	.165
COND	.222	1	.222	.877	.352
2-way Interactions	.056	1	.056	.219	.641
AGROUP COND	.056	1	.056	.219	.641
Explained	.778	3	.259	1.024	.388
Residual	17.222	68	.253		
Total	18.000	71	.254		

CATEG2 CATEGORY POST
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	.444	2	.222	1.097	.340
AGROUP	.222	1	.222	1.097	.299
COND	.222	1	.222	1.097	.299
2-way Interactions	.222	1	.222	1.097	.299
AGROUP COND	.222	1	.222	1.097	.299
Explained	.667	3	.222	1.097	.357
Residual	13.778	68	.203		
Total	14.444	71	.203		

POST (Combined posttests SICOM2 - CATEG2)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	4.806	2	2.403	1.234	.298
AGROUP	1.681	1	1.681	.863	.356

COND	3.125	1	3.125	1.605	.210
2-way Interactions	1.125	1	1.125	.578	.450
AGROUP COND	1.125	1	1.125	.578	.450
Explained	5.931	3	1.977	1.015	.391
Residual	132.389	68	1.947		
Total	138.319	71	1.948		

POSTc (Combined posttests SICOM2+OBCOM2)
BY AGROUP AGE GROUPS
COND CONDITION

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	2.028	2	1.014	.855	.430
AGROUP	.347	1	.347	.293	.590
COND	1.681	1	1.681	1.418	.238
2-way Interactions	.681	1	.681	.574	.451
AGROUP COND	.681	1	.681	.574	.451
Explained	2.708	3	.903	.762	.520
Residual	80.611	68	1.185		
Total	83.319	71	1.174		

Table C.5.

Summary tables showing means for all tests in Experiment 3

Summaries of Sign Comprehension by levels of Conditions and Agegroups.

	4,4 yrs	*5,6 yrs*
	0,5556	0,4444
Indirect	0,5113	0,5133
	18	18
	0,7222	0,7222
Control	0,4609	0,4609
	18	18

Summaries of Object Comprehension by levels of Conditions and Agegroups.

	4,4 yrs	*5,6 yrs*
	0,7222	0,5000
Indirect	0,4609	0,5145
	18	18
	0,6667	0,6667
Control	0,4851	0,4851
	18	18

Summaries of Production by levels of Conditions and Agegroups.

	4,4 yrs	*5,6 yrs*
	0,2222	0,3889
Indirect	0,4278	0,5016
	18	18
	0,3333	0,5000
Control	0,4851	0,5145
	18	18

Summaries of Depiction by levels of Conditions and Agegroups.

	4,4 yrs	*5,6 yrs*
	0,5556	0,7222
Indirect	0,5113	0,4609
	18	18
	0,5000	0,6667
Control	0,5145	0,4851
	18	18

Summaries of Category by levels of Conditions and Agegroups.

	4,4 yrs	*5,6 yrs*
	0,5000	0,5556
Indirect	0,5145	0,5113

	18	18
Control	0,6111 0,5016 18	0,7222 0,4609 18

Summaries of Verbal Concept (Combined tests T1+T2+T5) by levels of Conditions and Agegroups.

	4,4 yrs	*5,6 yrs*
Indirect	1,7778 1,2154 18	1,5000 1,0432 18
Control	2,0000 0,9701 18	2,1111 1,1318 18

Summaries of Full Meaning (Combined tests T1-T5) by levels of Conditions and Agegroups.

	4,4 yrs	*5,6 yrs*
Indirect	2,5556 1,6881 18	2,6111 1,5770 18
Control	2,8333 1,3827 18	3,2778 1,8409 18

Summaries of Comprehension (Combined tests T1+T2+T4+T5) by levels of Conditions and Agegroups.

	4,4 yrs	*5,6 yrs*
Indirect	2,3333 1,4951 18	2,2222 1,3086 18
Control	2,5000 1,2005 18	2,7778 1,5168 18

Summaries of Post (Combined posttests PT1-PT4) by levels of Conditions and Agegroups.

	4,4 yrs	*5,6 yrs*
Indirect	2,1667 1,5435 18	2,7222 1,4061 18
Control	2,8333 1,2005 18	2,8889 1,4096 18

Summaries of Sign Comprehension Post by levels of Conditions and Agegroups.

	4,4 yrs	5,6 yrs
	0,7222	0,7222
Indirect	0,4609	0,4609
	18	18
	0,7778	0,6667
Control	0,4278	0,4851
	18	18

Summaries of Object Comprehension Post by levels of Conditions and Agegroups.

	4,4 yrs	5,6 yrs
	0,5556	0,6667
Indirect	0,5113	0,4851
	18	18
	0,7778	0,8333
Control	0,4278	0,3835
	18	18

Summaries of Production Post by levels of Conditions and Agegroups.

	4,4 yrs	5,6 yrs
	0,3333	0,5556
Indirect	0,4851	0,5113
	18	18
	0,5000	0,6111
Control	0,5145	0,5016
	18	18

Summaries of Category Post by levels of Conditions and Agegroups.

	4,4 yrs	5,6 yrs
	0,5556	0,7778
Indirect	0,5113	0,4278
	18	18
	0,7778	0,7778
Control	0,4278	0,4278
	18	18

Total cases = 72
