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DEVELOPMENT OF LINGUISTIC AND COGNITIVE ASPECTS OF THE UNDERSTANDING OF SIMILARITY AND DIFFERENCE.

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Abstract

This thesis explores various aspects of children's understanding of similarity and difference and of the terms 'same' and 'different'.

Understanding of 'same' appeared to be good but there was some evidence that it might not be complete. Understanding of 'different' was clearly inferior to that of 'same' and some children misinterpreted it as meaning 'same', this being supported by an experiment looking at interpretations of 'same', 'different' and a nonsense word, following Carey.

Awareness of similarity and difference was investigated in several experiments. Subjects were required to give a similarity or a difference between two items, either named or pictured, in experiments developed from Claparede's work; they had to select from an array of items one either the same as or different from a target item and to justify that choice; and they had to judge whether two items were the same or not or were different or not in an experiment similar to one devised by Vurpillot.

The children found more difficulty with similarity than with difference. It was suggested that similarity was typically handled in a holistic fashion, by a process of analogy, while difference was treated by analysis into component parts. The ability to analyse similarity developed with age. If similarity is not analysed into component points, these points cannot be mentioned in responses.

An information-processing model of awareness was used to explain perseverative responses and the giving of differences when similarities were requested. It was suggested that these resulted in part from a failure to make transitions in awareness between different levels appropriately.

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Section I. The determination of similarities and differences between items.

Chapter 1. Introduction.

This first section is concerned with children's awareness of similarities and differences between objects. The investigations to be described owe much of their inspiration to a paper by Claparède (1918) directed towards just these problems, which will be described in some detail below. Other contributions to current thinking on the nature and rôle of awareness in cognitive development will then be considered and the chapter will conclude with a discussion of how the properties of objects and their relationship to each other might affect the responses given by children in the tasks set.

Although this work is concerned with awareness in children it is worth noting that there seems to be a revival of interest in awareness in psychology generally. Work on split-brain patients has led to speculation as to whether awareness is a function only of the left hemisphere or whether each individual possesses two centres of awareness, one of which is mute (Eccles, 1973). Weiskrantz et al. (1974) report a case of a man who following brain surgery was not aware of seeing anything in most of one visual field but could correctly "guess" the location, colour, shape and orientation of stimuli presented in that field, and Marcel and Patterson (1978) find a variety of effects indicating that their subjects semantically process words they are not aware of having seen.

Before proceeding to a consideration of work in cognitive development some clarification of how the term "awareness" is to be used seems in order. Polanyi (1968) draws a distinction between what he calls "focal" and "subsidiary" awareness. We are focally aware of what it is we are directly attending to at any moment and it is the contents of focal awareness on which we can report. In becoming aware of such focal targets we rely on subsidiary awareness of other particulars. Thus in listening to a speaker we are normally focally aware of his meaning and subsidiarily aware of the words he is using. We can shift our attention and our focal awareness to the words but we cannot at the same instant be focally aware of both words and message. For Polanyi subsidiary awareness covers all the things we rely on in attending to a focal target, including those of which we can never become focally aware, such as the particular movements of the ear drum in the above example. What follows is concerned only with focal awareness in Polanyi's sense. The simple term "awareness" will be used and where this involves translating the terms other authors prefer it is hoped that this does not do violence to their views.

Previously accepted views on the nature of awareness were much altered by Freud's insistence that there are such things as unconscious mental processes: that is, the conscious and the mental cannot be simply identified with each other. Unfortunately, the paper in which Freud set out his position on awareness has been lost, and his views must be gathered from comments in other works, especially a companion paper to the missing one, entitled 'The Unconscious' (Freud 1957, first published 1915).

In 'The Unconscious' Freud offers a three-way distinction between the conscious (Cs.), pre-conscious (Pcs.) and unconscious (Ucs.). The Cs. contains that of which we are actually aware, the Pcs. that of which we can become aware and the Ucs. that which is incapable of reaching awareness, sometimes but not always because it has been repressed by the Pcs. Mental processes in the Ucs. are different in kind from those in the Cs. and Pcs.: they do not allow contradiction, there is very free association of ideas and no regard for the passage of time or for external reality. The distinction between the Ucs. on the one hand and the Cs. and Pcs. on the other develops gradually in childhood, to become fully established at puberty. The critical factor allowing the possibility of awareness is language. An unconscious idea is represented by a charged memory-trace of an object, which can only enter awareness if it is linked to a charged representation of a corresponding word.

Given the absence of a sharp division between the unconscious and other systems in childhood and the nature of mental processes in the unconscious which Freud proposes one might well expect to find children's thinking to be strange or illogical but his theory does not allow precise predictions to be made.

It was in the climate of opinion stimulated by Freud that Claparède published the paper referred to above entitled "La conscience de la ressemblance et de la différence chez l'enfant" (Claparède 1918). This paper starts with a report of some experimental findings concerning children's ability to give similarities between objects and then a general theory of the origins of awareness is presented.

Claparède asked a number of children - the ages he reports range from 5 to 8 years - what was similar about a bee and, in succession, a wasp, fly, bird, rabbit, rose, stone and traffic accident. (The last is 'accident de voiture' in the original. It seems that at the time Claparède was writing 'voiture' could refer to either a horse-drawn or horseless carriage.) The actual results Claparède reports are anecdotal and therefore qualitative rather than quantitative in nature but the overall picture seems clear enough. The children, particularly the younger ones, found the task difficult and increasingly so as they proceeded down the series. On some occasions differences between the two items were given instead of similarities. Since the children might give similarities for the first cases and then start to give differences this could not be due to any simple misunderstanding of the question.

Some answers were less clearly right or wrong than others. Any relationship might be offered as a similarity e.g. a bee might be said to be like a bird because the bird eats the bee. Claparède comments that some answers were 'not so much felt as deduced'. Occasionally a binary comparison question was asked, e.g. if a child failed to give a similarity either between a bee and a rose or between a bee and a rabbit he would be asked whether the bee was more like the rose or more like the rabbit, and requested to justify his choice. This proved easier than the simple comparison, sometimes leading to quite sophisticated answers but on other occasions merely resulting in a child giving an answer in terms of a common difference e.g. a child asked whether a bee is more like a rabbit or a rose opts for the rose 'because the bee doesn't have ears like the rabbit'.

Claparède concludes from this study that differences are more available to awareness than similarities, children becoming increasingly aware of similarities with age. In drawing this conclusion he makes two plausible assumptions: firstly, that differences are given when similarities are asked for because differences are more available to awareness, and secondly, that awareness of a similarity is indicated by ability to articulate it.

Claparède never asked his subjects for differences, so his evidence that they are more aware of them than of similarities is indirect: simply that they sometimes offered differences when asked for similarities. Of course, if one grants the second assumption, it seems that in these particular instances the children must not have been aware of similarities between the items, or they would surely have given them, since as has been noted, simple misunderstanding of the question is not a possible explanation, and they must have been aware of the differences they cited. Why they should sometimes give differences in these circumstances is a mystery Claparède does not explain. However, we do not know what would have happened if the children had been asked for differences: they might not even have able to give the differences they offered spontaneously since doing something freely and doing it to order can be quite different tasks. They might on occasion give a similarity when no difference came to mind. So while a discussion of the rest of Claparède's paper must be based on an acceptance of this assumption some doubt concerning it must remain.

The second assumption is that if a child does not articulate a similarity he is aware of none. There seems no reason to question this in the case where differences are given instead, but what of instances where no answer at all is given? Could it not be that the child is aware of some similarity but unable to put it into words? This is a very similar objection to that made by Brainerd (1973) against the Piagetian practice of requiring children to give verbal justifications of their answers. For me it is difficult to imagine having a clear-cut awareness of something without being able to express it in some way. One may of course not be able to express oneself well, and in the present context of testing young children it is essential that they should feel sufficiently at ease to venture a somewhat poorly formulated response. Given that proviso the practice seems sound and indeed one wonders what better route to another's awareness there might be.

In the second half of his paper, Claparède presents a theory to explain his findings. He notes that although awareness of similarity is late in emerging children make much use of it automatically from very early in life. Symbolic play and over-extension in early language are two examples he cites. He wishes to explain this contrast as well as that between similarities and differences in the degree to which children are aware of them. In fact Claparède believes that his results are but one instance of a general law which he calls the law of awareness ("loi de la prise de conscience") and expresses as follows: "the child (or, in general, the individual) becomes conscious of a relation so much the later to the degree that his behaviour has involved the automatic (instinctive, unconscious) use of that relation the earlier and the longer". The paper then goes on to describe the mechanism by which Claparède believes one becomes aware of relations. This is disadaptation. The possibility of awareness arises whenever an individual's automatic reactions are not adapted to a situation and cannot adapt to it. Awareness is not inevitable in these cases, as intellectual development must also be sufficiently advanced, but there is no awareness without disadaptation. Clearly the purpose of this mechanism is to allow conscious adaptation when automatic processes fail.

The relationship between the law of awareness and the disadaptation mechanism is not clear. Obviously if both are to hold then either disadaptation must be less likely to occur in the case of long-standing automatic reactions or it must be less likely to succeed in inducing awareness in these cases. Both seem possible. In support of the former it can be noted that many of our earliest reactions have an innate basis and will be well adapted to their ends as a result of natural selection. For the latter possibility we can move from "the earlier" in the law of awareness to "the longer". It could be that continued automatic use of a relation in itself builds a barrier against that relation coming into awareness. It is a matter of common experience, as well as being attested to in the literature on skill (e.g. Legge and Barber, 1976), that in the acquisition of a skill such as handwriting or driving a car the actions can at first only be carried out under the control of awareness but later become automatic and it then becomes difficult for the individual to be aware of his actions in exercising such a skill. Such an argument is employed by Karmiloff-Smith (1978) in the context of children's assignment of gender to French nouns. She noted that her subjects, the younger ones in particular, used phonological clues in preference to any other but cited syntactic and semantic indicators when asked about what they had used. Karmiloff-Smith argued that the early and much used phonological process had become so automatic that it was not accessible to awareness in the way that the other processes, which had emerged later and were used more rarely, were.

Why should children be less aware of similarities than differences? Claparède invokes both the law of awareness and the disadaptation mechanism, though his argument in the former case is less clear. Claparède argues that the neonate is capable of sensing the differences between a vast number of different states of affairs but has only a few reactions at his disposal and so he must respond in the same way to a number of different situations, distinguished as different by the senses. That is, the first responses of the child involve the recognition of similarities, although at this stage there is no awareness of them. It would seem that the system must also take account of differences since although the same response must be made to a number of different situations there will obviously be instances where that response is inappropriate. However it may be that the way the system actually works is that a particular response is initially made to some set of situations (and the organism does not distinguish between these) and then new situations start to provoke that response on the basis of similarity so that difference has no actual rôle to play. This would certainly accord with Piaget's description of early development, (e.g. Piaget and Inhelder, 1969), whereby the domain for a particular reaction is gradually increased by a process of assimilation. So, since the individual makes use of similarities earlier than differences, by the law of awareness he becomes aware of similarities later.

Another consequence of the individual having few reactions at his disposal compared to the number of situations to which he must react is that disadaptation is more likely to occur with respect to differences than to similarities. That is, the invididual is more likely to respond similarly to situations requiring different responses than to act differently in two situations which actually required the same response. Also, if an individual believes that a situation calls for a particular response but then finds that that response fails, he knows that this must be because that particular situation is in fact different in some way from those in which the response works, and he has only to work out what the exact difference is. Failure, that is, can tell the actor that the new situation B is different from an old situation A. It cannot indicate that B is like an old situation C, and that the response appropriate to C is also appropriate to B. So the disadaptation mechanism also is more likely to bring differences into awareness than similarities.

Claparède indeed sees becoming aware of similarities as so difficult that he believes it to be the acme of mental functioning. He remarks that 'to find, in the mass of old experiences, that which has some hidden similarity with the present situation, is precisely the act of genius' and elsewhere that 'to think is to perceive similarities'.

One may infer from what Claparède says that once one has become aware of some relation that relation will subsequently be accessible to awareness. This seems the only way to connect his theory with his experiment. Presumably the similarities, and the differences, that the children report are those of which they have previously been made aware in active encounters. Some inventiveness is needed to imagine how this could have happened. Suppose a child says that a bee and a wasp are alike in that they both have stripes. By Claparède's account his awareness of this similarity must have arisen from an encounter when he reacted to one of these insects in a way different to that in which he would have done to the other, when the appropriate response was to treat them similarly because of their stripes. Perhaps in this case the story can be given some plausibility if one imagines that the consequence of the child's disadapted response was that he was stung, stripes on insects being an indication that they sting. However it would be difficult to concoct such scenes for each similarity and difference reported and it seems that nothing less precise will do. Take another instance, one which Claparède reports, of a child who can think of no similarity between a bee and a bird. Surely Claparède would have to agree that such a child, if asked how either a bee or a bird moved, would say that it flew, that is, he is aware that a bee flies and that a bird flies. The only thing that escapes his awareness is that they are alike in that they fly.

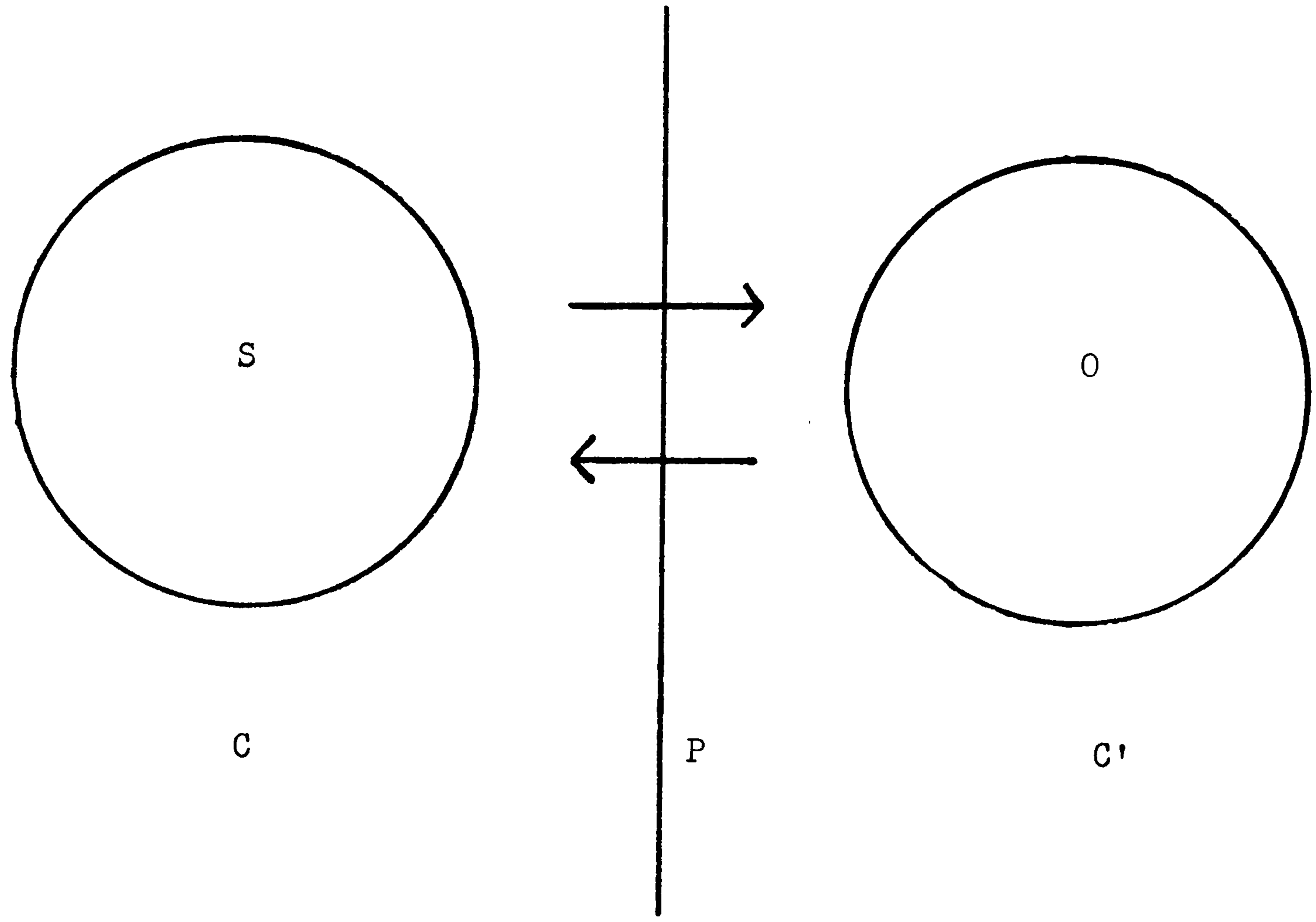
Claparède's theory seems then to stretch credibility even here, and it offers no explanation of why binary comparisons should be easier than simple ones or of why the children should ever give differences when asked for similarities. The order of difficulty of the items does seem to be an instance of the law of awareness, in that the ways in which the members of the last pairs in the sequence are similar are those with respect to which our earliest and most basic reactions are the same. The disadaptation mechanism carries some plausibility and probably should not be ruled out entirely but it seems that Claparède offers only a partial account of the origins of awareness.

Claparède's suggestion that all awareness arises from disadaptation is viewed with some disfavour by Campbell (1979) who sees it as portraying men as like automatons most of the time, only lighting up with awareness when they run into difficulties. This is perhaps overly harsh on Claparède. Firstly, the number of situations requiring awareness seems very large - for instance, on almost all occasions when we say something we must decide what to say consciously. Secondly, if as suggested above, Claparède believed that once an individual has become aware of something as a consequence of disadaptation it will be available to awareness in the future, we are likely to be aware of a great many things without having to run into difficulties concerning them each day. However, as has been said, it is difficult to see how disadaptation could be the sole source of awareness.

Piaget also, in his works on awareness, (Piaget 1977, 1978), acknowledges Claparède but argues that awareness can arise without disadaptation. Piaget's experiments on the growth of awareness all involve physical actions; thus his experiments are concerned with the kind of situations to which Claparède's theory, as well as his own, most obviously applies. Piaget set children aged from 4 to 12 a number of tasks such as playing tiddlywinks or solving the Hanoi tower problem. (Most, like tiddlywinks, were problems where physical action was of the essence rather than, like the Hanoi tower, logical problems in physical form.) Because of the physical nature of the problems, success was possible without awareness of how it came about and Piaget studied the children's gradually increasing awareness of what exactly they had done and of the nature of the objects with which they were dealing. According to Piaget failure can facilitate awareness but success does not prevent it. The process of assimilation, of cognitive structures enlarging the field on which they can be brought to bear, will lead to awareness without the intervention of disadaptation.

Claparède and Campbell speak of awareness as an all-or-none phenomenon: one is either aware of something or one is not with no intermediate position possible. Piaget however suggests that awareness can admit of degrees. He notes the existence of what he calls "elementary consciousness", referring to cases where one is transiently aware of something but this is not integrated with awareness of anything else. For Piaget integration is a principal characteristic of full-blown awareness and there is a continuum of degrees of awareness depending on the extent of integration. "Elementary consciousness" seems to be a kind of focal awareness, in Polanyi's sense, although as for subsidiary awareness, reporting on it is difficult.

Piaget's principal interest is in the changing content of awareness. In the first stage the child is aware only of the goal of his action and the results: success or failure in attaining the goal. (It is worth noting in passing that Kirkpatrick (1908) saw these two as the only functions of awareness: that it should set the goal and note the results while automatic mechanisms do the rest.) These two, goal and results, lie on the point of interaction between the subject and that on which he is acting and Piaget sees awareness as moving from this point towards the centre of both subject and object, as in Fig. 1:1, taken from Piaget (1977).



S	Subject
O	Object
P	Periphery
C	Centre of subject
C'	Centre of object

Figure 1:1. The double movement of awareness. (From Piaget, 1977).

Awareness, then, proceeds from the periphery to the centre. The movement towards C consists of the subject gradually becoming aware of the means he employed and the reasons for selecting those means. As awareness proceeds towards C'the subject becomes aware of the intrinsic properties of the object which determine how it responds to his actions. These two movements occur simultaneously.

The properties of objects which Piaget sees as the latest to come into awareness because they lie close to C'and are therefore the last to be reached by the centripetal movement of awareness are likely to be the same properties whose late emergence into awareness Claparède explained as being because they are those which control our earliest and most basic reactions. The two explanations may not be independent: no doubt it is because objects are as they are that our reactions are as they are.

Both theories concentrate on awareness arising through action although Claparède uses a verbal task to test for it. Piaget does however speak of awareness as consisting of assimilation through concepts, as opposed to practical assimilation in action, and this makes clear the possibility of awareness coming to be outside the context of physical action.

The above might seem a very limited discussion of the phenomenon of awareness, confined as it is almost entirely to considering the dawn of awareness of a few points in children. A few slightly more general remarks will be made in conclusion.

From an evolutionary point of view awareness must have arisen, in humans and possibly some other species as well, because it served some function. If we have awareness we are less strictly bound by rule than if we are limited to automatic responses arising from instinct and conditioning, and we can more flexibly assess a situation and possible courses of action in that situation. This of course also means that awareness is only useful when the solution which would be adopted by automatic means is not the best one. That is, Claparède was partly right when he said that awareness has its origins in disadaptation but it seems that this is more likely to apply phylogenetically than ontogenetically. Since automatic mechanisms may produce a solution in some situation which works, but is nonetheless not the best solution, there is an advantage to having awareness even when the unconscious reactions do not actually break down.

The remainder of this chapter will consist of a discussion of how the properties of objects and children's concepts of them are likely to affect both the difficulty of different comparisons in Claparède's task and the particular answers given.

Partial answers to these questions are implicit in both Claparède's and Piaget's theories of awareness, but the difficulties involved in applying Claparède's account have already been discussed. Piaget's contribution is clearer. Peripheral properties are more accessible to awareness and therefore it will be easier to give similarities between pairs of objects if they have peripheral properties in common than if their only shared properties are central ones. If two objects differ in their most peripheral properties then these differences will be more available to awareness than any similarities, though this is not a sufficient explanation of why differences are sometimes cited. Piaget's use of the central-peripheral terminology is not entirely metaphorical - a property, such as colour, which is physically on the surface of an object will be peripheral in his terms. To the extent that the terms are applied metaphorically, as in saying that "being an insect" is a central property, some intuition will be needed in applying them.

Another way of looking at the problem is in terms of the distinction made by Vygotsky (1962) between spontaneous and scientific concepts. Spontaneous concepts are those, such as "brother", learnt by the child in his everyday life, generally with respect to the objects in question. Scientific concepts are those explicitly taught at school, generally by verbal definition, that is, by relating them to other concepts. The child normally uses both kinds of concept correctly but Vygotsky found that conscious manipulation of scientific concepts precedes that of spontaneous concepts, which he attributes to the former's being linked to other concepts from the start. In time children learn to organise their spontaneous concepts in a network of concepts of both kinds and to the extent that they have done this they will be aware of these too. Although the difference between spontaneous and scientific concepts is presented as a dichotomy, the degree to which a concept is linked to other concepts must be a continuum, and awareness of concepts must be a matter of degree since Vygotsky found that the gap between the ability to handle spontaneous and scientific concepts occurred at different ages, depending on the precise task used. That is, the ability to manipulate a concept in one situation does not guarantee that ability in all situations. There should be some age group which finds it easier to give similarities between pairs of objects if they are instances of the same scientific concept than if they are instances of the same spontaneous concept, and children at this age should answer in terms of scientific concepts. This stage is unlikely to occur very early in the child's school career, both because the general difficulty of the task could depress performance with both kinds of concept and because the child will not then have acquired very many scientific concepts.

Although the distinction between spontaneous and scientific concepts is clear in principle it may be difficult to apply in practice. One could never be absolutely certain how a particular concept was initially acquired by an individual child. More importantly, scientific concepts will be introduced which refer to a category already served by a spontaneous concept, perhaps particularly with biological concepts. A child will have acquired such concepts as "bird" and "fruit" before starting school but at some stage in his schooling these terms will be explicitly defined and related to other concepts. This may simply speed up the normal process of the child organising his spontaneous concepts to which Vygotsky refers but it may lead to two concepts named by the same word existing side by side, at least for a time. Even in adults one occasionally finds uncertainty, for instance, as to whether or not a tomato is a fruit, and this could be because, as it were, it is a scientific fruit but not a spontaneous one.

The distinction between spontaneous and scientific concepts cuts across Piaget's classification in as much as a spontaneous concept could certainly involve either peripheral or central properties and in principle the same is true of scientific concepts although these may more often involve central properties.

In his paper Claparède comments that the answers he obtained sometimes indicated that the child was thinking of a particular instance denoted by the word in question and not of the category in general. He quotes the example of a child who gives "being yellow" as a property of a bird, because, Claparède believes, her image of a bird is of a canary. This comment is suggestive of recent work on the structure of natural categories by Eleanor Rosch (Rosch 1977; Rosch and Mervis 1975; Rosch et al. 1976). Rosch makes two principal claims: that natural taxonomies are so structured that one level, which can be objectively identified, can be regarded as more basic than the others, and that at all levels categories are organised around prototypes. One might say of Claparède's subject that for her a canary was a prototypical bird.

What Rosch calls the basic level in a taxonomy is the most inclusive level at which members of a category have many properties in common. Thus "chair" is a basic level category and members of the category chair have many shared attributes while members of the superordinate category furniture have comparatively few and members of the subordinate category dining chair do not share many more properties than do all instances of the basic level category. Basic level categories, then, have a high degree of internal similarity combined with a high degree of contrast with other categories at the same level. Rosch argues that because of this it is most efficient for people to conceptualise objects in terms of their basic level category membership and she offers (Rosch et al. 1976) several lines of evidence suggesting that they do in fact do so. If adults are asked to judge whether or not a picture is of a member of a particular category they are faster if it is a basic level category than if it is either a superordinate or a subordinate category. Adults name pictures with basic level names although they know appropriate superordinate and subordinate terms and even if the superordinate is of higher frequency in the language. Three year olds also name pictures with basic level names, even when these names are wrong. Five and six year olds find it easier to sort objects together if they are members of the same basic level category than if their only common membership is at the superordinate level. Rosch et al. also examined Roger Brown's data on the vocabulary of his subject Sarah at Stage I (Mean length of utterance 1.0 to 2.0

morphemes) and found that almost all the terms she used were names for basic level categories. Rosch's work suggests that the peculiar status of the basic level is even more enhanced for children, and especially very young children, than for adults.

This part of Rosch's theory suggests that it should be easier to give similarities between pairs of objects if they are members of the same basic level category than if they are not, without it being very much easier if they are also instances of the same subordinate category - the properties cited are likely to be properties at the basic level anyway. That is, there should be a discontinuity in level of difficulty at the point at which one moves from comparisons within basic level categories to comparisons across such categories. It may be that members of the same basic level category are seen as intrinsically the same kind of thing, while objects which have no common basic level category membership are seen as intrinsically different. One would expect any differences given in Claparède's task to distinguish between the objects in terms of their basic level category membership.

The other prong of Rosch's theory concerns the internal organisation of natural categories, of whatever level. Following Wittgenstein (1953) Rosch (Rosch and Mervis 1975) argues that there need be no property that is true of all members of a category, but that they are related by family resemblances. Members of a family tend to resemble each other because some of them will have the same colour hair and some of them the same shaped nose and so on but they would not all be expected to share any one feature. Similarly most chairs have legs but some modernistic ones do not, most have a horizontal surface but deck chairs do not, most can be sat upon but toy chairs cannot - there is no feature which is true of all chairs but several which are typical of chairs. Some chairs have more of these typical properties than others and these can be regarded as better exemplars of chairs, or, in Rosch's terminology, as prototypes for the category chair. Prototypes not only have more of the properties typical of their own category than non-prototypes, they also have fewer properties which are typical of other categories. When people hear a category name they tend to think of prototypes and this has effects such as that category membership statements can be verified faster if they refer to prototypes: "a sparrow is a bird" takes less time than "a penguin is a bird". It is, literally, easy to image prototypes for basic level categories, but prototypes must not be identified with images: they are abstractions from prototypicality ratings, and at levels higher than the basic level they cannot be visualised.

Bowerman (1977) has applied the notion of prototypes to children's early language learning. Her daughters' early words seemed to have a prototypical referent, almost always the first referent for which the word was used, while other referents were related to the prototype by a series of family resemblances. Thus the basic organisation of the child's categories is the same as for an adult although the variety of instances that may be included in one category by a child may make it appear bizarre.

Bowerman is of course considering a very early stage of development, before two years of age. By school age most terms will be very similar in extension to the adult's words but we do not know whether they would have the same prototypes. As noted, Bowerman found that the initial prototype was generally the first referent for the word. Where this does not coincide with the adult prototype the child will have to shift towards the adult norm at some point. The move to adult extension for a term will itself cause pressure to adopt the adult prototypes in cases where the child's initial prototype was different, as the latter will no longer have the characteristics of possessing more of the category's typical properties than other members of the category, but it could be that the initial prototype retains its psychological effects in that it is the category member which comes to mind when the category name is mentioned.

If categories are organised around prototypes in this way it is likely that answers to similarity problems will cite similarities between prototypes even when the properties given are not true of all members of the classes in question. This is the case with "they fly" as a similarity between a bee and a bird. No doubt the subject of Claparède's who gave this answer knew of the existence of flightless birds (though probably not of flightless bees). One feels that adults might well give the same response. Claparède's "canary" example raises a further possibility. What seems to have happened in this case is that the child has cited a property - being yellow - which is true of her prototype bird although not typical of the category in general and this when there are such typical properties as having wings available. It may be that this child's thinking was entirely tied to the prototype and that all the prototype's properties were equivalent for her, without any consideration of their distribution among other members of the category. This is of course but a single fragment of evidence but it will be interesting to discover whether other children show the same phenomenon.

As with Vygotsky's distinction between spontaneous and scientific concepts it may be difficult to apply Rosch's theory in practice because of the problem of identifying what are basic level categories and what are prototypical referents for any of the words used. Rosch argues that it is in the nature of the world that objects fall into categories, that these categories have a prototype and family resemblance structure and that one level of categorisation in a taxonomy can be considered more basic than others but she also acknowledges "that all cognitive categories are interactions between the correlational structures that exist in the world and the state of knowledge of the perceivers". (Rosch 1977). Indeed Rosch also acknowledges that not only the knowledge, but also the interests, of the individual and culture are involved. This accounts for her discovery that for her adult subjects "tree", "fish" and "bird" (and not for instance "oak", "salmon" and "sparrow") are basic level terms. Given that the knowledge and interests of children are different from those of adults it may well be that the level of categorisation which is basic for them will be different in some domains. Brown (1958) makes such a point when he speaks of objects being named for children at the "level of usual utility", which he now (Brown 1976) identifies with Rosch's basic level, and says that, for instance, for very young children all coins are simply named "money" because different value coins do not yet have different functions for them. A further problem is that atypical members of a basic level category may themselves form categories with some basic level characteristics. That is, "bird" may name a basic level category for many people but the categories "duck" and "ostrich" may exist side by side with it.

In spite of the various practical difficulties mentioned, it is hoped that the discussion in this chapter provides a framework within which the experiments to be described in the remainder of this section can be considered.

Chapter 2. Claparède's task: a replication and extension to two different modes of presentation.

Introduction.

The experiment to be reported in this chapter is an attempt to replicate that carried out by Claparède (1918) and described in detail in the previous chapter. It is hoped that the qualitative findings reported by Claparède will be repeated so that they can here be presented in a quantitative manner. These findings are: -

(i) That some children cannot say what is similar about two items, this difficulty being more common in younger subjects.

(ii) That some children who fail to give similarities in answer to a particular comparison will instead give differences. Some children give similarities in answer to easy problems and differences to subsequent more difficult problems.

(iii) That comparisons are more difficult to the extent that the items to be compared are more dissimilar.

(iv) That binary comparisons are easier than simple comparisons.

(v) That any point of contact between two objects may be cited as a similarity between them, as in Claparède's example of a child saying that a bird is like a bee because the bird eats the bee.

The nature of the answers given by the children to the similarity questions will be examined in an attempt to throw some light on the processes involved in their reaching these answers.

Claparède's procedure was entirely verbal. This is in contrast to the majority of cases where cognitive tasks are set children of this age group (about five to eight years) and in particular to the practice of Piaget and his associates who almost invariably use objects or pictures in their assessment of the child's abilities. Inhelder and Piaget (1964) report that such procedures can make it easier for a child to solve a particular problem - for instance, a child who correctly answers the class inclusion question 'Are there more primulas or more flowers?' applied to a number of pictures of flowers in front of him, states that there are more primulas when asked the same question about the flowers in the wood. However Wohlwill (1968a) claims that verbal presentation is not necessarily more difficult and he finds that in the particular case of class inclusion it is actually easier.

He found that his subjects fell into two groups: those who were consistently incorrect in the pictorial condition and those who made some correct responses in that condition. Of the former group exactly half scored zero in the verbal condition also, while the others showed some apparent improvement. Of the latter group nearly 80% improved their performance with verbal presentation, achieving higher scores than would be likely by chance and generally accompanying their correct answers by correct explanations. Wohlwill concluded that these latter subjects were children who possessed the basic logical abilities required in performing the operation of class inclusion but were hindered in the actual performance by biases induced by pictorial presentation.

In view of this difference of opinion in the literature it seems worthwhile to ask the question whether verbal or pictorial presentation would be easier in general in Claparède's task and whether any difference would be particularly marked in subjects who obtain intermediate scores. In order to answer that question, both verbal and pictorial presentation are employed in the present experiment.

In the previous chapter various possible frames of reference in which to view the results obtained using Claparède's task were discussed. It was acknowledged that there would be difficulties in applying any of these but the attempt will be made to see whether each of them can be applied, and whether they aid understanding of the mental processes involved in performing the task. It is not that these theories will be tested against the results obtained. The questions to be asked are, can they be applied to the kind of data resulting from Claparède's task with any degree of confidence, and if so, do they afford any insight into the situation?

The first of these frames of reference is the central-peripheral dimension proposed by Piaget (1977). Although this distinction is made between the two ends of a continuum it will be easier for present purposes to treat it as a dichotomy, between the more central and the more peripheral. Possible relationships between Piaget's theory and Claparède's task were considered in a general way in the previous chapter. Here some specific predictions will be made. If the children's answers can be divided into those which cite central properties and those which cite peripheral ones:

(i) Since pairs of items early in the series have more peripheral properties in common than later pairs, similarities given between these items will be more likely to cite peripheral properties.

(ii) Answers from older children will give a higher proportion of central properties than those from younger children, as the younger find access to central properties more difficult. This will be the case particularly for the earlier problems, where there are adequate peripheral similarities available, and therefore no incentive for the younger children to look for central ones. Older children may give central properties even in answer to these problems, as it is not particularly effortful for them to do so, and a central property may well seem a 'better', a more sophisticated, answer.

(iii) Differences, which suggest a lack of awareness, will cite peripheral properties.

No specific predictions are made concerning answers citing relations (as they will hereafter be called e.g. the bird is like the bee because the bird eats the bee) or answers to binary comparison questions, but these will also be looked at in the light of the central-peripheral distinction.

The effect of pictorial as opposed to verbal presentation has also to be considered. Those properties of objects which are directly portrayed are peripheral ones. One may therefore make the following prediction:

(iv) A higher proportion of answers given to pictorially presented problems will cite peripheral properties than those to verbally presented problems.

The second theory considered in the previous chapter as possibly useful in the present situation is Vygotsky's account of spontaneous and scientific concepts. The previous discussion suggested that this might be particularly difficult to apply to the answers given to Claparède's task. According to Vygotsky there is a stage of development at which spontaneous concepts are not accompanied by awareness to the same extent as scientific concepts and are consequently more prone to error. So if this distinction is to be useful then the following prediction must be supported:

(i) At some level of development (i.e. age group) answers employing scientific concepts will be more likely to be similarities than will answers employing spontaneous concepts.

The last possible frame of reference considered in the previous chapter was Rosch's theory of the organisation of natural categories. This theory makes two major claims, firstly that for natural categories, one level of categorisation in a hierarchy is more basic than the others and secondly that all natural categories are organised around prototypes. From this, the following predictions are made:

(i) If items to be compared are members of the same basic level category the problem will be much easier than otherwise.

(ii) Properties of basic level prototypes will be cited in preference to others, and

a) older children will show a greater ability to cite other properties than younger children

b) answers other than similarities especially will cite properties of basic level prototypes.

In general it must be assumed that children have the same category structure - the same basic level and the same prototypes - as adults although the younger the child the more open to question is this assumption. Since adults show considerable agreement on these matters the writer's own intuitions will be used, spelled out where appropriate, but the possibility of the children's systems being different will not be forgotten.

The rôle of the pictures used in that form of presentation is also to be considered in relation to Rosch's theory, but no specific predictions are made.

Method.

Subjects.

In all, 147 children were tested and these were divided into six groups as follows:

N1 (Nursery 1). 18 children, 1 aged 2:9, the others 3:4 - 4:3.
Mean age 3:8, median 3:8.

N2 19 children aged 4:5 - 5:4, mean 4:10, median 4:11.

P1 (Primary 1). 27 children aged 4:11 - 5:5, mean and median 5:3.

P2 30 children aged 6:6 - 6:11, mean and median 6:9.

P3/4 30 children aged 7:5 - 9:10, mean 7:11, median 7:9.
This group composed of:

P3 24 children, 1 aged 8:3 and the others 7:5 - 7:11, mean and median 7:8.

P4 6 children, 1 aged 9:10 and the others 8:6 - 8:11, mean 9:0, median 8:11.

P5/6 23 children, two aged 11:7 and the others 10:0 - 10:11, mean 10:8, median 10:7.

Both N1 and N2 contain a mixture of children from two playgroups, one run in the psychology department and used mainly by the children of the academic staff and one in the local community where the parental occupations would generally be of similar status - indeed also containing many academics' children - but some would be of lower socio-economic status than in the former case. The division between N1 and N2 was made simply on the basis of age.

The four P groups came from a local primary school, all those in any one school class being included in the same group. That is, those markedly different in age from the others had been kept back by the school (one in P3, one in P4 and two in P5/6). P1, P2, P3 and P5/6 were complete school classes. P5/6 was said to be a composite class but all the children seem to be of the primary six age group. This makes for an unfortunate gap, the only nine year old child to be tested being one of those held back. The children in P4 were part of a composite primary 3/4 class. The primary school in question was situated in what might be considered a deprived area, and the population is therefore different from that providing the subjects in N1 and N2.

The age range used extends beyond that apparently used by Claparède in both directions. The nursery children were tested so as to establish a fairly low starting level of performance. It was originally intended that only the children in P1, 2 and 3 would be tested from the primary school but the older children were included when it became obvious that nothing like a ceiling level was reached by the former groups.

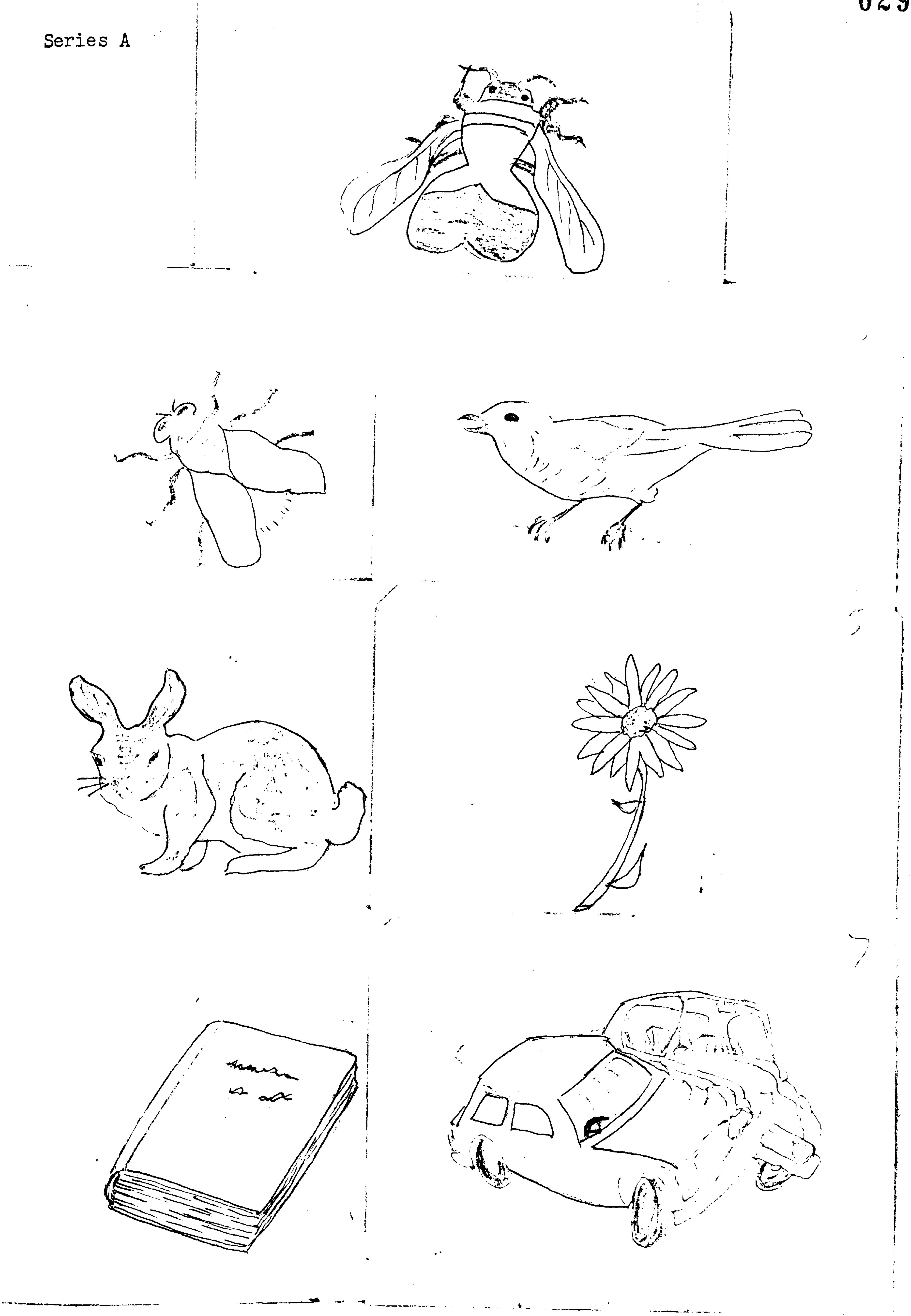
Stimuli.

Two series of items were used, the first member in each being compared with the other members of its series in succession. The series were:

Series A bee fly bird rabbit flower book car crash

Series B fish crab seal cow tree comb birthday party.

Series A



<u>Figure 2:1.</u> (continued over)

Series B

Figure 2:1. Stimulus materials used for pictorial presentation.

Pictures of all the items were drawn and are reproduced in Figure 2:1. It must be noted that although a car crash and a birthday party are not objects, pictures of them are necessarily pictures of objects. Series A is almost identical with the series used by Claparède, the changes made (omission of wasp, substitution of flower for rose and book for stone) being mainly for ease of pictorial representation.

Terminological note: In what follows, 'an item' refers to an object or event in the above list, while 'a problem' refers to a pair of items presented to the children for comparison.

Procedure.

Each child was tested on both series, receiving one in verbal and the other in pictorial form. Half of the subjects received A pictorially and B verbally and the other half A verbally and B pictorially, and half of each of these groups were given the verbal condition first and the other half the pictorial condition first. As far as possible these proportions were maintained within the subject groups but the vagaries of testing sometimes made the numbers a little uneven. Table 2:1 shows the exact numbers receiving each order of conditions.

AV - BP	2	8	7	7	8	6	38
BP - AV	8	2	6	9	7	5	37
AP - BV	3	5	8	6	8	6	36
BV - AP	5	4	6	8	7	6	36
AV & BP	10	10	13	16	15	11	75
AP & BV	8	9	14	14	15	12	72
V - P	7	12	13	15	15	12	74
P - V	11	7	14	15	15	11	73
	N1:18	N2:19	P1:27	P2:30	P3/4:30	P5/6:23	Total 147

AV - BP - A series presented verbally followed by B pictorially, etc.

Table 2:1. Numbers of subjects receiving different testing schedules.

The differences in number in the N groups, which are less marked in the subtotals, are due to the division between N1 and N2 being post hoc, the two not being tested as separate groups.

All children were tested in rooms separate from but close to their playroom or classroom, the experimenter and subject sitting side by side at a table. At the start of testing the child was told "What I want you to do is to tell me what's the same about some things." For verbal presentation, the experimenter proceeded, using series A as an example, by saying "First of all, a bee and a fly. What's the same about a bee and a fly?" If the child did not then give a similarity, prompts were utilised as given in Table 2:2.

Child's response	Prompt
No response	Can you think of anything that's the same about a bee and a fly?
"Nothing" (or equivalent)	See if you can think of anything the same about them, a bee and a fly?
A relation	They do go together like that but it's not really something the same about them, is it? Can you think of anything the same?
A difference	That's a way that they're not the same, isn't it? Can you think of anything the same?

Table 2:2. Prompts.

Only one prompt was given for each comparison although if a child's response was unclear or unintelligible an attempt was made to elucidate it. (For instance if a child offers "a bee flies" in answer to the bee-fly comparison it is not clear whether he regards this as a similarity or a difference.) The experimenter noted whether a similarity had been given for the problem and proceeded to the next. When two problems had been administered without a similarity being given a binary comparison question was asked e.g. "Is a bee more like a fly or more like a bird?" and when this was answered e.g. "fly", "And why is a bee more like a fly?" Prompts were given for binary comparisons as for simple comparisons and the children were also prompted if they did not initially make a choice.

Pictorial presentation was similar to verbal, but no names were used in referring to the depicted items. All the pictures for the appropriate series were set out on the table, the two for the particular problem were selected and placed directly in front of the child and he was asked "What's the same about this one and this one?" When all the problems had been administered in the pictorial condition the child was asked to name the pictures as a check that they were correctly identified. The pictures were also occasionally used in the verbal condition: if there was any suspicion that a subject did not understand the names used, the pictures were put in front of him and he was asked to pick out the uncertain item.

The precise wording of the instructions might vary slightly. If a child failed to give a similarity either to simple or binary comparison questions for three problems in a row or if he was obviously restless the series was terminated. All testing sessions were tape-recorded for later transcription.

Results.

Sample protocols.

The protocols of four children, one from each of the primary school groups, are given as examples in Appendix 2:1. The cases were selected so as to show a range of abilities and to illustrate as many as possible of the points made in the text. The youngest child, Lynn, falls approximately into the bottom quarter as regards performance both in terms of number of problems attempted and number of similarities given. Michael falls at the median on both measures. Diane and Alexander both come into the top quarter, Alexander being one of the top four subjects in terms of number of similarities given.

Names given to pictures.

If the results from the pictorial presentation condition are to be compared with those with verbal presentation, knowledge of how the pictures were identified by the subjects is important. Pictorial presentation using a picture of a rabbit is only equivalent to verbal presentation using the word 'rabbit' if the picture is seen as a rabbit and not as a cat or an animal. There are then two questions to be answered: could the children correctly identify the pictures? and did they identify them at the level expected by the experimenter?

Table 2:3 summarises the position for the twelve pictures of objects (i.e. excluding car crash and birthday party, which will be considered later). Occasionally a child would give more than one name for a picture: these extra names are too few to distort the overall picture and are included.

	bee	fly	bird	rabbit	flower	book	fish	crab	seal	cow	tree	comb	total
%age correct responses	60	67	95	93	92	94	96	88	36	95	99	88	83
%age incorrect responses	33	27	5	4	5	0	1	7	54	0	0	7	12
%age no responses	7	5	0	3	3	6	3	5	11	5	1	5	4
Absolute number of responses	75	73	73	72	73	72	75	75	76	75	75	75	889

Table 2:3. Naming responses by item.

Names considered correct are: 'bee', 'bumblebee', 'fly', 'bluebottle', 'bird', 'rabbit', 'bunny rabbit', 'flower', 'daisy', 'book', 'blue book', 'fish', 'fishie', 'crab', 'seal', 'cow', 'tree', 'comb'. The vast majority of correct names given were those used in the verbal condition, or only trivially different from them. There were five instances each of bumblebee and bluebottle and three of daisy, at least some of which were probably not true subordinates. The one instance of 'blue book' seems more a description than a name.

The names classified as wrong were not in general such as to suggest misidentification of the pictures: most were incorrect subordinates, such as 'parrot' for the bird and 'sunflower' for the flower, or names of related objects, such as 'brush' for the comb and 'sealion' for the seal, which accounted for 39% of all responses to the seal picture and was the only error to be made by any child in P5/6. The most common errors for bee and fly were to call each by the other's name, each also being called by other insect names and 'spider'. Nineteen children used the same name for both these pictures.

The level of 'no responses' seems acceptably low, and may often indicate reluctance rather than inability to respond. The 11% figure for the seal is a little worrying, combined with the fact that this picture elicited a number of bizarre errors: 'bird', 'eagle', 'owl', 'snail'. Some children may have had difficulty identifying this one picture.

The two pictures which have not been considered so far, the car crash and the birthday party, give rise to different problems. These were intended to portray events, but were often named as objects, as Table 2:4 shows.

All responses to car crash, except 'no responses' were correct but only 15% specified an event. The birthday party was much more successful in this respect, 60% of subjects saying that it was of a birthday, a party or a birthday party, but this picture also elicited a few incorrect answers, such as 'children making cakes' and 'queen'.

Where the pictures were used as a check on understanding in the verbal condition the children were almost always successful in picking out the required item, but one child in N1 and two in N2 claimed to be unable to find a fly, two children in N2 could not pick out a seal, one in N1 could not find a cow and one in P1 failed to find a crab. This is not a perfect test: the failures may just indicate inattention and success in matching picture to word is no guarantee that the word was understood in the original entirely verbal situation, but the high level of performance is reassuring.

car crash		birthday party	
% crash	15	% birthday, party	60
% crashed cars	17	% children, food	29
% cars	65	% other	7
% 'no response'	3	% 'no responses'	4
Absolute no. of responses	72	Absolute number of responses	75

Table 2:4. Naming responses to car crash and birthday party pictures.

Number of problems attempted.

The majority of testing sessions were terminated before all problems had been administered, the mean numbers of problems attempted by children in the different age groups being as follows:

N1	N2	P1	P2	P3/4	P5/6	Total
7.1	10.6	7.9	9.6	10.5	11.5	9.6

Table 2:5. Mean no. of problems attempted, out of 12.

In all, 45 children attempted all 12 problems, and these were distributed across the age groups as follows:

	N1	N2	P1	P2	P3/4	P5/6	Total
No.	1	9	1	6	12	16	45
% of group	6	47	4	20	40	70	31

Table 2:6. Distribution of subjects completing the task.

The difference between the groups in the number of problems administered is statistically significant (Kruskal-Wallis 1-way analysis of variance, $H = 56.5$, $df = 5$, $p < .001$). Inspection of the means shows this difference to have two sources: age and the population from which the subjects were drawn. This result is to be taken into account in the subsequent analysis.

Response categories.

The children's answers to those problems they attempted were classified in 4 categories:

1. Similarities. Any response presented by the child as a similarity between the items, even if tendentious or untrue.
2. Relations. Any relation between the two items which is neither a similarity nor a difference e.g. Michael's response to the bee-flower comparison 'That one goes on flowers'.
3. Differences. Any difference between the two items.
4. No responses. No response at all, 'don't know', 'nothing', simple assertions that the two items are the same or that they are different, unintelligible or irrelevant responses. (There were a very few responses under the last two heads.)

This list could be regarded as a hierarchy, with a similarity as the best kind of response and a 'no response' as the worst. Some responses included in the 'no response' category might be thought of as superior to some of those further up the list but they are put in this order because the 'no responses' are uninformative.

Any response consisting of more than one part was classified according to the part which would come highest in the above list, e.g.

Lynn's response to the bee-rabbit comparison, 'Cos that's a rabbit and that's a fly so that's not the same', is considered a difference although 'That's not the same' on its own would be classed as a no response. In cases where there were two responses to the same problem, one given after prompting, the first was recorded for purposes of analysis unless the prompted response would fall into a higher category in the above list, in which case it was recorded instead. Responses to binary comparison questions were classified in the same way as those to simple comparisons.

Number of similarities given.

Figure 2:2 shows the proportions of answers of different kinds given by the children in the various age groups, both for the subjects as a whole and separately for those who attempted all problems. It should be borne in mind that in the latter case N1 and P1 are not groups, but single children. Prediction 1 was that some children would have difficulty in giving similarities, which is evident from the figure, and that this difficulty would be more marked for the younger children. The differences between the groups in proportion of answers given which are similarities are statistically significant, both for the subsample and for the whole group (Kruskal-Wallis 1-way analysis of variance, subsample: $H = 15.32$, $df = 5$, $p < .01$; whole group: $H = 55.23$, $df = 5$, $p < .001$). Inspection of Figure 2:2 suggests that, as with the number of problems attempted, not only age but also subject population is having an effect. The statistical tests are likely to be conservative, as when carried out on the whole group a higher proportion of the problems attempted by the younger subjects will be the earlier ones, which should be easier if prediction 3 is supported, while if the subsample is used the younger age groups are more highly selected and may include only the brighter children.

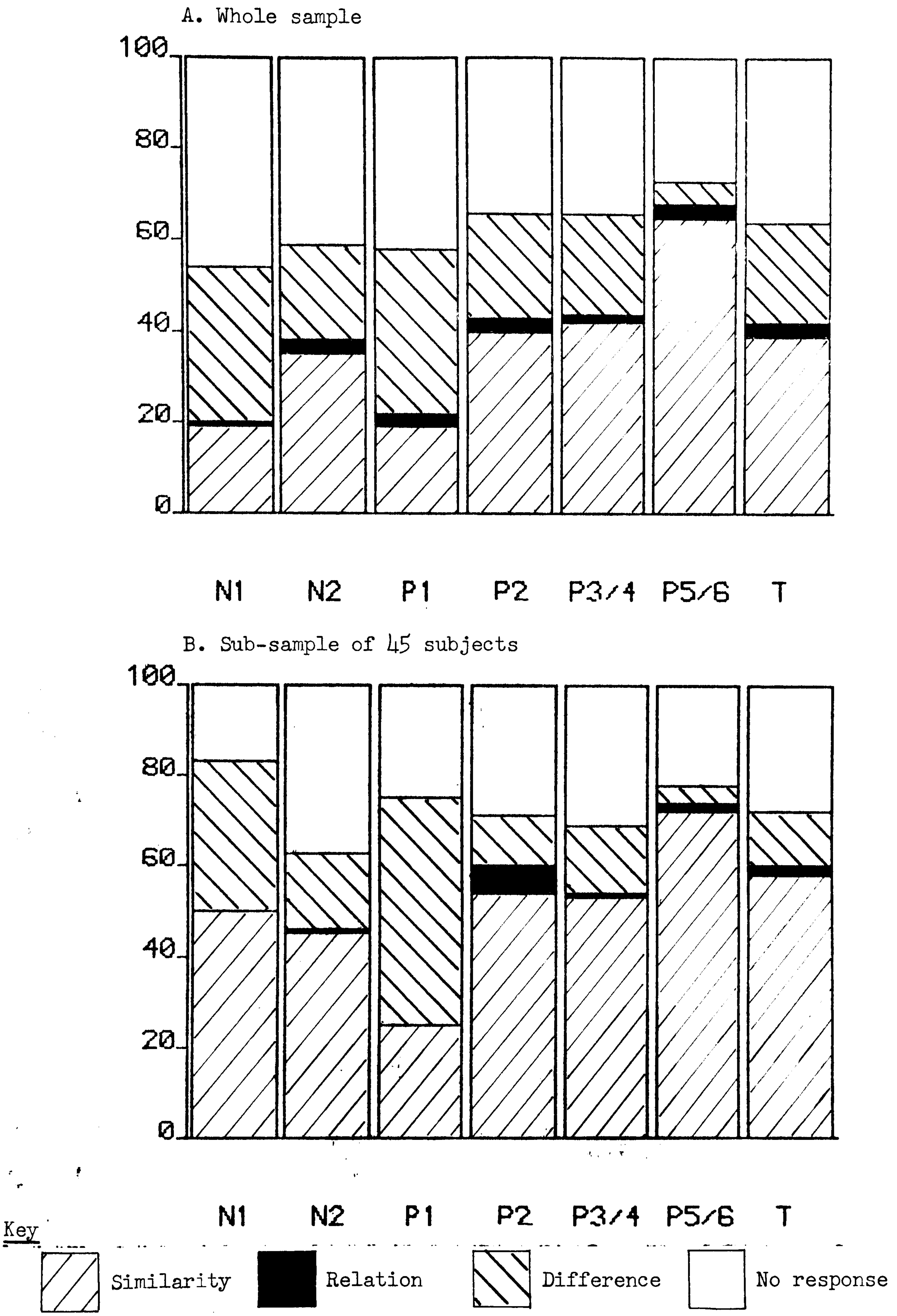


Figure 2:2. Percentages of responses falling into different categories.

Differences given.

Prediction 2 was that some children would give differences, and more precisely that they would give similarities in answer to earlier problems and differences to later ones. This is clearly supported. 81 of the 147 children gave at least one similarity and at least one difference. (Of the remaining 66 subjects, 43 gave only similarities, 18 only differences and 5 neither of these.) If the children's responses to series A and series B are considered separately, these 81 subjects produced 98 series of responses containing both similarities and differences. Of these, in 68 cases all similarities came before any difference, in 4 cases all differences came before any similarities and the remaining cases were mixed.

Difficulty of problems.

Prediction 3 was that problems later in the two series would be more difficult than earlier ones. Figure 2:3 shows the percentage of children in the subsample who attempt all problems who give a similarity in answer to each of the problems in the two conditions. The Spearman rank correlation coefficient between the proportion of children giving a similarity and position in the series, taken across both series and conditions, is -0.86 ($p < .001$) for this subgroup. The prediction is therefore supported, despite the bumps evident in Figure 2:3.

Binary comparisons.

Prediction 4 was that binary comparisons would be easier than simple ones. Some children were not asked any binary comparison questions as they did not have sufficient failures with simple ones,

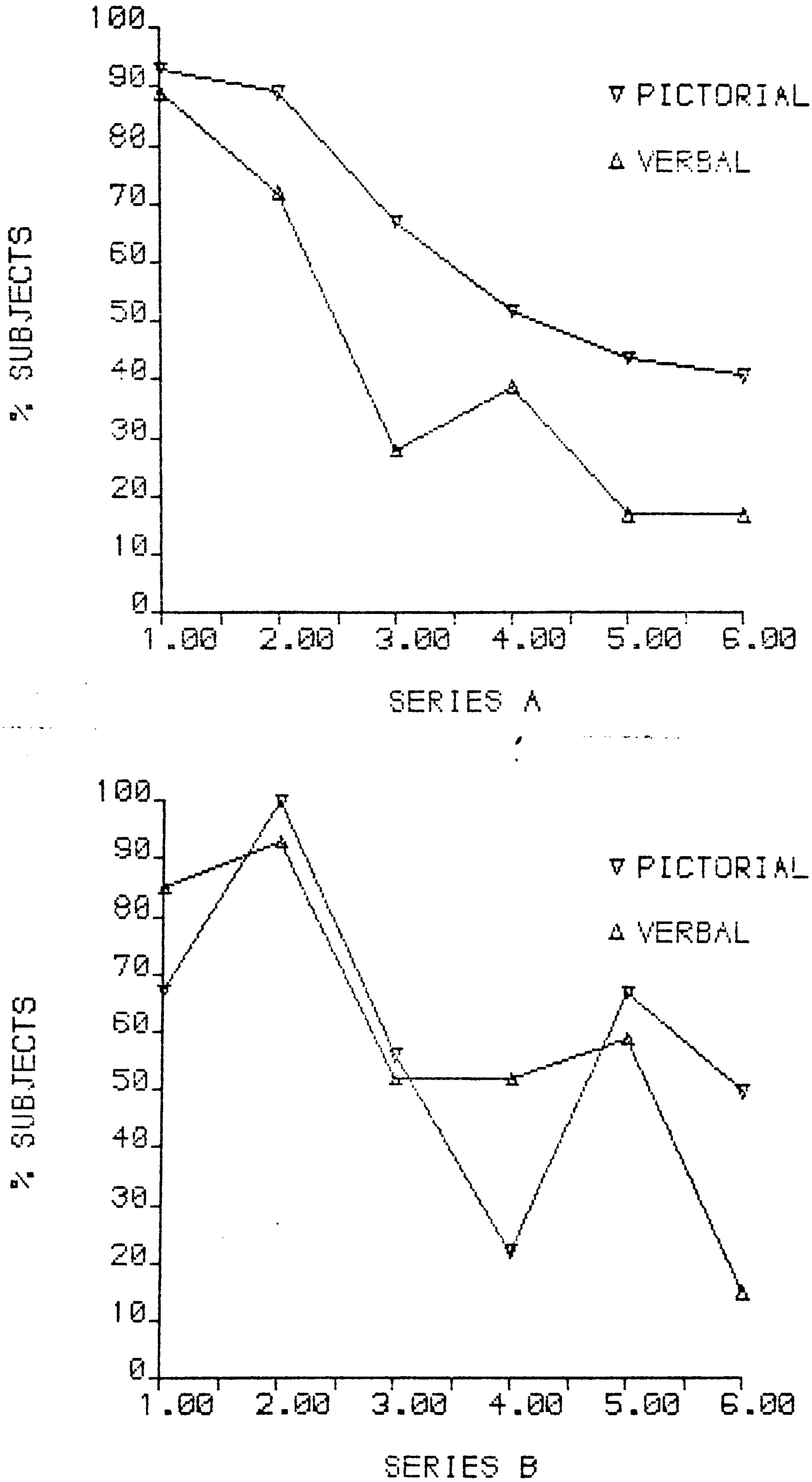


Figure 2:3. Proportions of subjects out of sample of 45 giving similarities in answer to different problems.

and a larger number refused to make any binary choices, so there are only 122 children to be considered here. Overall these subjects gave similarities in answer to 37% of the simple comparison questions they were asked and to 53% of the binary comparisons. 72 children gave a higher proportion of similarities in answer to binary comparisons than to simple ones, 36 the reverse, and 14 gave the same proportion of similarities in their answers to both types of question. This difference is statistically significant (sign test, $Z = 4.76$, $p < .001$). Since the children were only asked binary comparison questions in relation to problems they had failed as simple comparisons, the difference between the two types is likely to be underestimated by taking the proportion of similarities given.

Relations.

The fifth prediction was simply that some responses of the type which have been called relations would occur. This is so: 32 children gave at least one relation, 41 such responses occurring in all. The small number of these responses prevents very much being said about them. They are not given by children of any particular age group nor by those of any particular ability level, as assessed by the number of similarities given. There was however considerable variation in the extent to which different problems elicited such responses, as Table 2:7 shows. The comparison between a bee and a flower contributed over half the relations: bees were said to like, eat, go or land on flowers and to collect honey, nectar, pollen, holly or polythene from them. Some suggested connections between the items were more tenuous, such as that fish might be eaten at a birthday party.

Series A	No. of relations	%age of answers	Series B	No. of relations	%age of answers
Bee - fly	1	1	Fish - crab	3	2
bird	1	1	seal	1	1
rabbit	1	1	cow	0	0
flower	22	17	tree	1	1
book	5	5	comb	0	0
car crash	0	0	birthday party	6	10

Table 2:7. No. and percentage of relations given in answer to different problems.

Verbal versus pictorial presentation.

The next point to be considered is whether the children found verbal or pictorial presentation to be easier. Figure 2:3 suggests that pictorial presentation was easier in general , although not for some problems in the B series. The question was tested statistically by comparing the number of similarities each subject gave in the two conditions, using a sign test. Where a subject had taken different numbers of problems in the two series the smaller number was taken into account for both series. 69 subjects were then found to score higher in the pictorial condition and 28 in the verbal condition, the remaining 50 having the same score for both conditions. This difference is statistically significant ($Z = 4.06$, $p < .001$). There seems to be no connection with level of ability, most subjects at all levels of ability, in terms of number of similarities given, finding pictorial presentation slightly easier than verbal presentation. The difference between the two modes of presentation, although consistent, is small: 112 of the 147 children had scores for number of similarities given which did not differ by more than one between the different conditions.

Analysis of answers by content.

So far the children's answers have only been considered as similarities, differences, relations and no responses. In the introduction a number of frames of reference within which the content of the answers could be assessed were proposed. These will be considered below, but first some general comments on the kinds of similarities the subjects offered will be given, so as to give an overall picture. The protocols in Appendix 2:1 also give some idea of the nature of the children's responses.

Content of similarities.

As it is similarities with which we are principally concerned they alone are considered here. Tables 2:8 and 2:9 show the kinds of answer given.

	Age group:	N1	N2	P1	P2	P3/4	P5/6	Total Verbal	Total Pictorial	Total Total
Category names	Number	3	5	2	4	$3\frac{1}{3}$	$8\frac{1}{2}$	$4\frac{1}{3}$	$21\frac{1}{2}$	$25\frac{5}{6}$
	Percentage	12	7	5	3	3	5	2	7	5
Physical properties	No.	8	19	11	$23\frac{1}{2}$	22	$11\frac{1}{2}$	$26\frac{1}{2}$	$68\frac{1}{2}$	95
	%	32	27	28	20	17	7	11	21	17
Motion	No.	7	$17\frac{1}{6}$	$4\frac{1}{2}$	33	$34\frac{1}{3}$	$35\frac{1}{2}$	80	$51\frac{1}{2}$	$131\frac{1}{2}$
	%	28	25	11	28	26	21	34	16	24
Common part	No.	2	$16\frac{5}{6}$	$8\frac{1}{2}$	$31\frac{1}{2}$	$33\frac{1}{6}$	$41\frac{1}{2}$	$55\frac{1}{2}$	78	$133\frac{1}{2}$
	%	8	24	21	27	25	24	24	24	24
Similar part	No.	0	2	4	18	20	28	21	51	72
	%	0	3	10	15	15	16	9	16	13
Habitat	No.	2	6	6	5	$13\frac{5}{6}$	25	$21\frac{1}{3}$	$36\frac{1}{2}$	$57\frac{5}{6}$
	%	8	9	15	4	11	15	9	11	10
Other	No.	3	4	4	2	$4\frac{1}{3}$	21	$24\frac{1}{3}$	14	$38\frac{1}{3}$
	%	12	6	10	2	3	12	10	4	7
Total	No.	25	70	40	117	131	171	233	321	554
	%	100	100	100	100	100	100	100	100	100

Table 2:8. Content of similarities by age group and presentation condition.

Problem:		Series A 1	2	3	4	5	6	Series B 1	2	3	4	5	6	Total
Category names	No.	16½	2	4	-	-	-	1	2⅓	-	-	-	-	25⅚
	%	16	2	10				2	3					5
Physical properties	No.	6	11	10	13	7	7	3	8	5	7	12	6	95
	%	6	13	25	46	35	35	5	9	17	32	32	38	17
Motion	No.	33⅙	45⅓	6	-	-	3	14	26	2	-	-	2	131½
	%	32	53	15			15	22	30	7			13	24
Common part	No.	42⅓	25⅓	8	2	1	-	8½	27⅓	17	-	2	-	133½
	%	41	29	20	7	5	-	13	31	59		5		24
Similar part	No.	-	1	8	7	7	5	2	1	1	11	23	6	72
	%		1	20	25	35	25	3	1	3	50	62	38	13
Habitat	No.	-	-	1	-	-	-	34½	22⅓	-	-	-	-	57⅚
	%			3				54	25					10
Other	No.	6	1⅓	3	6	5	5	1	1	4	4	-	2	38⅓
	%	6	2	8	21	25	25	2	1	14	18		13	7
Total	No.	104	86	40	28	20	20	64	88	29	22	37	16	554
	%	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 2:9. Content of similarities by problem.

Examples of each kind of response can be found in the protocols. Category names were generally specific (e.g. 'both bees') but sometimes superordinate (e.g. 'both animals'). Physical properties covers all similarities citing such properties as colour, shape and size, including cases where only parts of the items are said to have a common colour, or whatever. Similar parts are answers such as Michael's to the bee-flower comparison: 'Cos it's got petals and that's like petals (wings)'. Motion, common part and habitat are self-explanatory. Most answers in the 'other' category cited other properties or activities of the items, a few of them quite sophisticated, such as 'living' or 'growing'. Two examples from this category are Diane's response to the bee-book comparison, 'Both begin with "b"' and Alexander's to the bee-car crash problem, 'Both make a noise'. Compound answers such as 'They can fly and they've both got wings' are considered to be composed of equal parts summing to 1 and account for the fractions in the tables.

These tables are intended to give a general picture. Their use is limited by the fact that different children gave different numbers of similarities and in answer to different problems - in particular, a high proportion of the answers to later problems were given by older children. Some comments can be made however.

The only age trend to stand out is the decline in the importance of physical properties with age. Many of these responses cited colour, particularly those from the younger children, so that the trend would have been even more striking if colour alone had been considered.

Category names, physical properties and similar parts were more common with pictorial than with verbal presentation. Specific category names such as 'They're both bees' are obviously more reasonable responses to the question 'What's the same about this one and this one?' than to 'What's the same about a bee and a fly?' The direct portrayal of physical properties and similar parts with pictorial presentation may account for the differences in these cases.

Motion and 'other' responses were more common with verbal than with pictorial presentation. Answers referring to the mode of motion of the items were made predominantly to the first two comparisons in each series, especially the A series. The children's favoured answer to the bee-fly and bee-bird comparisons was 'They fly' with verbal presentation, but 'They have wings' when presented pictorially. The difference in 'other' responses between the pictorial and verbal conditions may reflect a difference in strategy when the most common answers fail, as they form a higher proportion of answers to the more difficult problems. It may be that with pictorial presentation the pictures are scrutinised for some point of similarity and some non-essential agreement in colour or a similarity of parts is cited, while with verbal presentation the children must think of some unusual type of answer.

There are very considerable differences between the problems in the kinds of answers they elicit: habitat is a striking case, given with one exception in answer to only two comparisons, fish-crab and fish-seal. Category names are only given to earlier problems because it is easier to find a common category name in these cases. Similarly motion should only be a possible answer for the earlier problems but reappears for the last in each series, when presented pictorially, because the pictures can be taken as representing objects capable of motion rather than events. The number of physical properties cited tends to increase with difficulty of problem. The experimenter was sometimes given the impression that these were regarded as not very good answers by the subjects and were given only if something they regarded as better could not be found.

The subjects showed much greater agreement in their responses to the first two problems in each series than to the later ones, the popular answers for the A series being already given. For the B series they were 'They swim' and 'They live in water (or the sea)'. For most other problems some similarity of colour is the most common answer given.

Piaget's central-peripheral distinction.

The first frame of reference considered in the introduction within which to consider the content of the children's answers was Piaget's central-peripheral dimension. Most of the children's replies cited what seemed to be clearly peripheral properties of the objects. Answers in the 'similar parts' category involve some degree of abstraction, but it seems to be purely empirical abstraction, in Piaget's terms.

A few answers seemed to involve more central properties. These were those citing properties such as having motion or being coloured (as opposed to employing a particular mode of movement or being a particular colour) and potentialities such as 'can be eaten' or 'can be cut'. Category names are also considered central properties in that they, as it were, point to the essence of the thing named.

The small number of central properties mentioned, and the fact that they were in different numbers from different children and in answer to different problems, makes assessment of the situation difficult, but some attempt can be made.

The first prediction made in connection with the central-peripheral distinction was that similarities offered for problems early in the two series would be more likely to cite peripheral properties than those for later problems. Only 29 subjects offered both central and peripheral properties as similarities and these were about evenly divided as to whether they mentioned central properties to earlier or later problems, on average, than those which they answered in terms of peripheral properties.

The second prediction was that older children would cite a higher proportion of central properties than younger ones. Of the small number of subjects who gave central similarities, nearly half were in the oldest group, the others being spread across the younger age groups as Table 2:10 shows.

	N1	N2	P1	P2	P3/4	P5/6	Total
Number	3	3	2	5	5	14	32
% of group	17	16	7	17	17	61	22

Table 2:10. Numbers and percentages of children offering central properties as similarities.

These figures are however difficult to interpret: since the oldest children give the most similarities of any kind they have the most opportunity to give central ones. It is clear that the second part of the hypothesis, that the age difference would be most evident in the earlier problems, is not supported: it is the oldest group alone who tend to give central similarities in answer to the later problems.

The third prediction was that differences would cite peripheral properties. In fact, of 313 differences, 96, or 31%, involved central properties. This compares with only 9% of similarities and so is clearly contrary to expectation. The 41 relations on the other hand were all peripheral, but this is probably in their nature, since they involve putting objects in the same scene, as it were.

The final prediction concerning central and peripheral properties was that a higher proportion of answers with pictorial presentation would be peripheral in nature than those with verbal presentation. Although difficult to assess, the evidence points in the opposite direction: 16 subjects gave a higher proportion of peripheral similarities with verbal presentation than with pictorial presentation, only 11 giving a higher proportion in the pictorial condition. Of the 12 problems only 3 elicited a higher proportion of peripheral properties in the pictorial condition while 7 did so in the verbal condition.

It must be admitted that application of the central-peripheral dimension to the present results is limited, both because the answers split so unevenly between the two categories and because support for the hypotheses derived from it is so weak. Post hoc it was noticed that the picture seemed distorted by the inclusion of specific category names, which formed a large part of the number of central similarities - indeed, a quarter of all central similarities cited were specific category names given in answer to the bee-fly comparison. If specific category names were to be excluded from consideration the results become more in line with the hypotheses, as follows:

(i) There remain only 20 children citing both central and peripheral properties as similarities, fifteen of these tending to give peripheral properties in answer to earlier problems than central ones, and only five doing the reverse.

(ii) The figures given for P5/6 in Table 2:10 remain the same while those for all other groups are reduced, accentuating the age difference.

(iii) Central properties account for 6% of similarities and 3% of differences.

(iv) 8 subjects give a higher proportion of peripheral similarities with verbal than with pictorial presentation, and 12 the reverse. 6 problems elicit a higher proportion of peripheral properties in the verbal condition and 4 in the pictorial condition.

Vygotsky's distinction between spontaneous and scientific concepts.

The possibility of applying Vygotsky's distinction between spontaneous and scientific concepts has now to be considered. Although it is difficult to know when one is dealing with scientific concepts it seems that they are rarely employed in the children's answers. The size, shape and colour of the objects, their mode of motion, their habitat and their body parts all seem to be spontaneous concepts. Possibly the best instance of a scientific concept in the corpus is 'animal' as applied to insects, birds and fish as well as mammals. However this occurs only seven times in answer to simple comparison questions, always as a similarity. Other possible candidates for scientific concepts are 'insect', 'living' (as applied to both animals and plants) and 'gills'. Of these, only 'gills' appears other than as a similarity. The relations recorded included, as noted above, suggestions of bees collecting from flowers such odd things as holly and polythene and this could be a result of the children attempting to relate a misunderstood school lesson to their spontaneous concepts. Given that even if the net is stretched as wide as this the number of answers involving scientific concepts is small, it is not reasonable to look for differences in their employment, either between age groups or as to whether or not they are mentioned as similarities.

Rosch's theory of natural categories.

We now come to the last suggested frame of reference, Rosch's theory of natural categories. The first prediction based on this theory was that comparisons would be much easier if they were between members of the same basic level category. Most of the problems clearly involve comparisons between members of different basic level categories, the one possible exception being the comparison of a bee and a fly. Rosch was surprised to find, in her own investigation of biological taxonomies, that 'tree', 'fish', and 'bird' seemed to be basic level categories for her adult subjects, whereas she had expected them to be superordinates (Rosch et al. 1976). On this basis one might expect 'insect' to be a basic level category also. The names given by the children to the pictures may be of assistance here, as it is a characteristic of basic level category names that they are the ones used in such a task. As reported above, 19 children, or 26% of those receiving series A with pictorial presentation, called the pictures of the bee and the fly by the same name, which strongly suggests that they regard them as members of the same basic level category. In addition, one child transposed the names, calling the fly 'bee' and the bee 'blue-bottle'. This child, and possibly others also, may have seen the task as demanding two different names although their most naturally given names for the two pictures would have been the same, so the 26% figure may be an underestimate. As already noted in connection with Piaget's theory, some children, when asked for a similarity between a bee and a fly, said that both were bees, flies or some other species. Others, like Michael, gave answers to the effect that they were the 'same animals'. These answers also suggest that the bee and the fly are members of the same basic level category for the subjects in question. A few such answers were recorded for the fish-seal comparison but not for any other problem. No child in P5/6 gave any of the answers considered in this paragraph but there did not seem to be much difference between the other groups. It seems likely that the bee-fly problem involves a comparison within a basic level category for a considerable number of the subjects and one might therefore expect this problem to be distinctively easier than all the others.

The bee-fly comparison was attempted by all 147 subjects and 70% of them gave a similarity in answer, making this indeed the easiest problem. The bee-bird and fish-seal comparisons come next: each of these was attempted by 146 subjects and 60% of them answered with a similarity in each case. If P5/6 is excluded from consideration, as there is no evidence that this comparison is between members of the same basic level category for this group, the gap widens but only to 67% versus 54% of the answers being similarities. Only for N1 does there seem to be a marked contrast between this problem and the others, 56% of the group answering it with a similarity, as contrasted with 24% for both the bee-bird and fish-seal comparisons, and there is no independent evidence that this group were more given to regarding the bee and the fly as instances of the same basic level category than the other younger age groups. There is then support for the hypothesis but it is not very strong.

The second hypothesis drawn from Rosch's theory is of much more general applicability. This was to the effect that the children's answers would cite properties of basic level prototypes of the items as far as possible.

Some problems, and some answers to them, raise particular difficulties in assessing the prototypicality or otherwise of the responses. Uncertainty as to whether 'bee' and 'fly' are basic level or subordinate categories is one instance. Another difficulty is provided by answers such as Diane's to the bee-book comparison, to the effect that they both start with the same letter. There were five such replies, and they were accepted as similarities, although they are not similarities between the items themselves.

Prototypicality of similarities.

If answers citing specific category names and spelling responses are excluded there remains a corpus of $535\frac{2}{3}$ similarities given, counting parts of compound answers as fractions as for Tables 2:8 and 2:9. Alternatively, but no less arbitrarily, if each part is counted as 1 the number of similarities rises to 557. Of these, 95, or 18% of the total, on the former method of counting, (96 or 17% by the latter method) are not true of the prototype of at least one of the items compared. As the judgement of prototypicality depended solely on the writer's intuitions a list of answers considered non-prototypical is given in Appendix 2:2.

The number and nature of the non-prototypical similarities depended on the presentation condition. On either method of counting, 11% of similarities given to verbal presentation were non-prototypical and twice as many - 22% - of similarities given to pictorial presentation. Most of the non-prototypical answers given to pictorial presentation (60 out of 70) were true of the pictures concerned - generally fine details of the pictures and often concerning colour, for instance pointing out the yellow stripes on the bee and yellow writing on the cover of the book. These answers indicate that the children could use the pictures as alternative sources of information to their own prototypes. However there were also indications that the prototype could dominate the picture. The writer had assumed that a prototypical fish is silvery in colour, although the picture used was actually of a goldfish - a fairly typical fish, and probably the one most familiar to the children other than those seen on the dinner plate. Several answers however indicated that the children were thinking of green fish and some of these came from children receiving pictorial presentation with this series. Two such children said that the fish and the tree were the same colour, one of them specifying green, and another that the fish and the (green) crab were the same colour. In the latter case it could be that it is the prototypical crab that is orange, rather than the prototypical fish being green. In any case, the pictures are not being used as the basis of the reply but seem rather to be pointers to the child's concepts of the objects portrayed.

Of the remaining cases, several answers may be true of the child's own prototype though not of the writer's estimate of a prototypical member of a category. In some instances the property cited is true of some members of a category: for example, one child stated that a bee and a bird were both yellow, as in the case reported by Claparède. Other answers, such as Alexander's that a fish and a seal both have gills, are not true of any member of one of the categories concerned. In two cases subjects made it explicit that their answers were only possibly true of the objects in question: a comb can be green (like a fish - from a child in P2 given verbal presentation) and party hats could sometimes be fish-shaped (P3/4, verbal presentation).

Age differences in prototypicality.

It was hypothesised that the older children would be more likely to give non-prototypical answers than the younger ones. The question is again complicated by the fact that different children gave different numbers of similarities, and in answer to different problems. The proportions of similarities given by the different age groups which were non-prototypical are displayed in Table 2:11. The numbers of subjects who made any non-prototypical responses are given in Table 2:12.

Group	N1	N2	P1	P2	P3/4	P5/6	Total
% non-prototypical similarities	32	24	32	23	19	6	18

Table 2:11. Percentages of similarities given by each age group which were non-prototypical.

N1		N2		P1		P2		P3/4		P5/6		Total	
N	%	N	%	N	%	N	%	N	%	N	%	N	%
2	11	9	47	7	26	11	37	12	40	7	30	48	33

Table 2:12. Absolute numbers of subjects, and percentages of age group, who give non-prototypical similarities.

These tables suggest that it is actually the younger children who give more non-prototypical similarities. As the older children give more similarities of any kind than the younger they have more opportunity to give non-prototypical ones and this may account for the rise from N1 to P3/4 shown in Table 2:12. The following drop to P5/6 and the drop shown with age across all groups within a subject population in Table 2:11 cannot be explained by the difference in problems attempted by each group, as it is actually the problems later in the two series which elicit more non-prototypical responses, as Table 2:13 shows.

Problem by position in series	1	2	3	4	5	6	Total
% Non-prototypical similarities	6	10	20	40	23	58	18

Table 2:13. Percentages of similarities which were non-prototypical for problems at different positions in the series, summed across series and

Non-prototypicality, differences and relations.

We now come to consider whether answers other than similarities were prototypical or not. It was hypothesised that errors would be even more likely than similarities to cite properties of basic level prototypes though where apparently non-prototypical answers are due to a child employing an unusual prototype this may not be the case. In fact only a tiny proportion of the differences given consisted of non-prototypical responses: 6 out of 313, or 2%. One of these was with pictorial presentation: only four of the bee's legs are visible in the picture and it was said to differ from the fly in this respect. The instances given with verbal presentation consisted of two cases of crabs being said to be unable to swim, one each of a bee and a fly being unable to fly and one of a fly being thin.

The proportion of non-prototypical relations was much more similar to that for similarities: 7 out of 41 or 17%. Again only one was with pictorial presentation: a response to the fish-birthday party comparison to the effect that the balloons could be filled with water - the most tenuous relation between two items to be offered. One child asserted that bees eat flies, four claimed that fish were eaten at parties and one that one could go to a party dressed as a fish.

Binary comparisons and prototypicality.

Finally, similarities given in answer to binary comparison questions can be compared with those offered to simple comparisons as to their prototypicality. 31% of similarities offered in response to binary comparisons were considered non-prototypical, and they were given by 38 different subjects, or 31% of those who answered any binary comparison questions. The higher proportion of non-prototypical answers given does not seem to be due to binary comparisons being asked in connection with problems later in the two series than simple comparisons, on average, as a comparison of Table 2:14 with Table 2:13 shows.

Position of problem in series	1	2	3	4	5	6	Total
% Non-prototypical similarities	11	28	28	38	63	33	31

Table 2:14. Percentages of non-prototypical similarities given in answer to binary comparison questions for problems at different positions in the series.

Discussion.

This experiment has supported the claims made by Claparède. Children do have difficulty in giving similarities between pairs of items, often giving differences (and occasionally, relations) instead. A child who can give similarities between very similar items will often make such errors when comparing comparatively dissimilar items. Not surprisingly, older children perform better at the task than younger ones. The binary comparison form of question is easier to answer with a similarity than a simple comparison question. The replication of Claparède's findings extends to the content of the answers given: compare, for example, Michael's answer to the bee-flower problem, 'Cos it's got petals and that's like petals' with the response given by one of Claparède's subjects 'Les pétales de la rose resemblent aux ailes de l'abeille'. However the main purpose of the present experiment was to seek understanding of what is happening in Claparède's task, replication of his findings being a necessary preliminary.

The element in this experiment which was not part of Claparède's study, the contrast between verbal and pictorial presentation, will be considered first. In general pictorial presentation was found to be somewhat easier than verbal, though this was not true for all problems. Which presentation condition was found easier, and to what extent, was not related to the general ability of a child in performing the task, so there was no support for the suggestion made by Wohwill (1968a) considered in the introduction. It may be that with pictorial presentation the child has one fewer stage to go through; he merely has to compare two representations whereas with verbal presentation he first has to create and hold in mind two representations, be they visual in nature or not. It might be argued that a pictorial representation is fixed while a mental one has the advantage that it can be varied until a point of similarity is found, but the evidence that items were conceived in terms of their basic level prototypes suggests that mental representations may also be somewhat fixed. Incidental details in the pictures could be cited as similarities and were often chosen for the more difficult problems: for instance, four children pointed out the similarity between the lines drawn to indicate pages in the book and those indicating veins in the bee's wings. Even if the representations created by the children in the verbal condition were visual in nature they might not contain such fine detail, or such details might be dismissed as irrelevant in that condition.

The two final problems, A6 and B6, showed a greater advantage to pictorial presentation than most, as this can convert a comparison between an object and an event into one between two objects. An unintended advantage was given to pictorial presentation by the mode of procedure. As stated in the method section all seven pictures for the appropriate series were displayed at once. This was simply for ease of administration, but meant that all comparisons in this condition could be effectively binary, or involve even more items. Only one answer suggested such a strategy: a child in P3/4 said of a bee and a fly "A fly is quite the same because it's got wings and flowers haven't got wings and can't fly". This was the first problem altogether to be administered to this child so she must have thought of this method of comparison herself without any prompting due to previous binary comparison questions asked by the experimenter. Most children may not have paid any attention to any pictures other than the two to which they were specifically directed but the possibility cannot be ruled out.

The specific content of the answers given by the children, whether they mentioned a common part, a common global physical property or whatever, varied very much from problem to problem, as might be expected. This variation is a good reason for looking for a more general frame of reference than is provided by categories such as common part. However, there were problems involved in applying all the frames of reference considered, and Vygotsky's distinction between spontaneous and scientific concepts could not be applied at all.

At first sight Piaget's central-peripheral dimension did not seem to fit the data but the picture improved greatly when specific category names were excluded. It seems that the distinction does capture a real difference in the data, but that it cannot be applied to all the answers given. An object's name, or its category membership, is not really a property it possesses, and Piaget's distinction did seem to apply to true properties. The oldest group was different from all the others in that almost all the answers citing properties such as living and growing came from that group. No child in P5/6 ever offered a specific category name in answer but this group gave more superordinate category names than any other. The movement seems to be not from the periphery to the centre but from properties, including names, at one level, to those at a higher level. Although there was an abrupt change on reaching the oldest group the higher level answers were very much in a minority even from these children.

The suggestion that it is levels in a hierarchy of categories which are involved brings us to a consideration of how well Rosch's theory fitted the results. There was evidence that the bee and the fly were members of the same basic level category for some of the subjects and that this contributed to the comparison between them being the easiest of all the problems. Rosch's basic level fixes the starting point for the ascent to higher levels referred to above.

Most of the similarities which the children gave seemed to be prototypical, in Rosch's terms. Indeed, there was some evidence with pictorial presentation that the children occasionally answered in terms of their prototype for an item even when this meant that their reply was not true of the picture in question. Some of the apparently non-prototypical similarities offered were false and these and others were probably due to aberrant prototypes. Non-prototypical answers given with pictorial presentation were sometimes true of the pictures and this possibility provides another reason for the pictorial condition being found easier than the verbal one. Pictorial presentation was consistently easier only for the A series and some answers suggested that the goldfish which was the constant picture for the B series was not a prototypical fish for at least some subjects. One can speculate that the pictures were helpful only when prototypes were represented, non-prototypical features then being useful extras, but that a picture which as a whole was not prototypical did not aid the children's responses. These two types of answer, those due to atypical prototypes and those true of the pictures, appeared to account for most of the similarities classified as non-prototypical. There seemed to be very few answers citing properties which were possibly true of at least some members of the category but were not part of the prototype.

As expected, differences given were almost always prototypical, although relations were no more so than similarities. Answers to binary comparison questions were less likely to be prototypical than those to simple comparisons. Contrary to expectation the older children gave fewer non-prototypical responses than the younger ones. It had been thought that the older children would be better able to conceive of items other than in terms of their basic level prototypes and therefore would be more likely to give answers of the possibly true variety. As has been said there did not seem to be many such answers, and the older children tended rather to give more sophisticated prototypical answers, such as properties considered to be central in the Piagetian classification. False answers came more often from the younger children so the picture might be changed somewhat if it were known for certain just what is prototypical for a particular child.

It is now appropriate to attempt an overall view of what happens when a child performs Claparède's task. The task as set by Claparède, that is, presented verbally, will be considered first.

The evidence suggests that on hearing the names of the items the child conceives of them in terms of their basic level prototypes. As Rosch (1977) has warned, prototypes are not images. If they were, age differences in properties cited would be surprising, and differences given although similarities were requested would be unexplained. It is rather as though the prototypes were lists of properties, some more salient than others. If the basic level prototypes of the items coincide, as they would seem to do for the bee and the fly for some subjects, any property is a similarity between them and the child can simply mention the one which is most salient for him. If the prototypes are different the most salient feature may be a difference or a relation and the child must resist the temptation to cite that feature. An account of this sort, supposing frequent failures to resist the temptation, seems to be the only way to explain the results. As noted, most of the children who gave differences also gave at least one similarity. It cannot be that they believe they have been asked for a difference. It also seems unlikely that they understand that they are being asked for a comparison but do not know what sort of comparison, or think that the question is neutral as between similarity and difference as in that case one might expect more differences to be given to the easy problems: there are after all many and striking differences, as well as similarities, between a bee and a bird, for instance. Furthermore, some of the children who give differences are quite old - seven of them are in P5/6, at the age of ten or eleven and it does not seem credible that they do not understand the question. Rather it seems that they cannot keep hold of the question when the salient points to strike them are differences. It was noted in the previous chapter that control has often been thought of as one of the main functions of awareness, and it seems to be this aspect which is important here. The child's intellectual processes do not seem to be fully under the control of his awareness but can at times be taken over, as it were, so that he is forced into an error which he would recognise as such if he were in complete control of his faculties.

On the above account differences would always be prototypical, as indeed they almost always were, in terms of the writer's prototypes. Relations were less often prototypical and it may be that they have two sources. A child giving a relation may be seeking some point of contact between the two items but be unable to find a genuine similarity. Occasionally relations were offered somewhat hesitantly, as if the subject were aware that it was not a wholly adequate response. Other relations were probably given in the same way as differences, the highly prototypical relations between a bee and a flower being cases in point. Such relations certainly leap to mind when a bee and a flower are mentioned together but they are less striking if one of the items is considered alone. That is, it may well be that the context of the comparison alters the relative salience of various properties of the items. Binary comparison questions may facilitate the giving of similarities also by altering the salience of properties. If for instance a child has said that a bee is more like a rabbit than a flower this may increase the salience of the properties of animals as opposed to plants. However the upshot of a binary comparison question was not always that the child chose the item which might be expected - he might, as Michael did, choose the flower in the above example - and in this case the facilitating effect cannot occur.

Binary comparison questions were sometimes successful in eliciting similarities after 'no responses' had been given to the corresponding simple comparison questions, as well as after differences. If they work by altering the salience of properties this must mean that there is a threshold of salience below which a property is not available to awareness. This is plausible in the light of the results: only the oldest children seemed to have access to the property 'living' for example, yet surely the youngest know that a bee and a fly etc. are living. This may seem to be simply to restate Claparède's point that very general properties are the last to become available to awareness, but the jargon of modern cognitive psychology does seem to give his ideas a more concrete form. It is likely that some properties are stored in such a way that they cannot come into awareness and that others are permanently available to it, and that there is a third category the availability of the members of which depends on some degree of salience or level of excitation.

Claparède's disadaptation mechanism for promoting awareness has considerable problems associated with it, as discussed in the previous chapter. He may have been led to overemphasise the importance of disadaptation because it arises principally in the presence of the unexpected or the odd and it is the unusual which is actually important. It was noted that the habitat of items was given in answer (with one exception) only to the fish-seal and fish-crab comparisons but was given so often for those as to merit inclusion in Tables 2:8 and 2:9. Aquatic, as opposed to terrestial, habitat can be considered an oddity and it therefore seems to have greater salience.

Most of the above account, given for verbal presentation, holds for pictorial presentation also. The pictures were reasonably prototypical and it was suggested that in some cases they were simply used as cues to a child's own prototypes. However if a child was unable to find a prototypical similarity between the items the pictures did enable an answer to be given in terms of non-prototypical details portrayed in them. It is thought that this is the main reason for pictorial presentation being found easier than verbal presentation. Even in cases where prototypical answers were given the pictures seem to affect the relative salience of properties of the items. This is most evident for the bee-fly comparison where 'they fly', or answers to that effect, accounted for 54% of similarities given with verbal presentation and only 11% with pictorial presentation, while 'they have wings' accounted for 19% and 41% respectively. The import of the two answers is of course very similar, but the wings are directly portrayed in the pictures. A similar but less marked variation is found for the bee-bird comparison and also for the fish-crab and fish-seal comparisons, where motion is again relatively more common with verbal presentation and habitat much more common with pictorial presentation. Since habitat is not directly portrayed this result is more difficult to explain.

Finally, it seems appropriate to address a controversy amongst workers in cognitive development. If a child apparently shows some intellectual ability - the ability to conserve number, to take another's point of view or to give a similarity between two items - in some contexts, but in others he makes seemingly illogical errors, should he be credited with that ability or not? The Piagetians tend to say he should not, but there are others who argue that at least in some cases he should be (e.g. Donaldson 1979, Gelman 1972, Flavell and Wohlwill 1969). The position is not all-or-none of course; some such illogicalities could well be due just to performance factors such as memory span, or to the introduction of a second and more difficult task alongside the first, while others are not. In the present case a child who gives some similarities and some differences seems to have the same ability to understand the comparison question as a child who gives similarities and no differences, but he cannot be credited with the same degree of fully aware control of his intellectual processes.

Appendix 2:1: Sample Protocols

Lynn 5:3

Series A: pictorial presentation

Bee and fly	That's not the same fly.	
(prompt)	Just the wings that's the same.	S
bird	Just a wee bit the same	N
(prompt)	(No response)	
rabbit	Cos that's a rabbit and that's a fly so that's not the same	D
(prompt)	(No response)	
bird or rabbit?	(No response)	
flower	No	N
(prompt)	Not the same	
bird or flower?	It's not like that or that	
names?	rose bird book car rabbit fly fly (bee)	

Series B: verbal presentation

Fish and crab	(No response)	N
(prompt)	(No response)	
seal	No	N
(prompt)	(No response)	
crab or seal?	A wee bit like a shark	
(prompt)	Not like anything	
cow	(No response)	N
(prompt)	(No response)	
crab or cow?	(No response)	
	(identifies pictures correctly)	

Michael 6:9

Series A: pictorial presentation.

Bee and fly	They're both the same animals.	S
bird	They can both fly	S
rabbit	Don't know	N
(prompt)	(No response)	
flower	I think it - that one goes on flowers.	R
(prompt)	(No response)	
rabbit or flower	(Flower) Cos it's got petals and that's like petals (wings).	S
book	Don't know	N
(prompt)	(No response)	
rabbit or book?	(Rabbit) Because it's a animal and the other one isn't	S
car crash	Don't know	N
(prompt)	(No response)	
book or car crash	(Car crash) I don't know	N
names?	book fly flower bird rabbit two cars bee	

Series B: verbal presentation

Fish and crab	(No response)	N
(prompt)	Don't know	
seal	They both swim	S
cow	Nothing	N
(prompt)	(No response)	
crab or cow?	(Crab) Don't know	N
(prompt)	Don't know	
tree	Nothing	N
(prompt)	(No response)	
cow or tree?	Don't know	
	[illegible]s crab, cow, tree)	

Diane 7:8

Series A: verbal presentation

Bee and fly	Don't know	
(prompt)	They fly	S
bird	That's a funny one	N
(prompt)	I don't know	
rabbit	One of them can't fly and the other one can.	D
(prompt)	(No response)	
bird or rabbit	(Bird) Cos it can fly.	S
flower	The bee collects honey	
(prompt)	They both got honey	S
book	Both begin with 'b'	S
car crash	I don't know	N
(prompt)	(No response)	
rabbit or car crash	(Rabbit) Because a bee's got a little drop fur	S

Series B: pictorial presentation

Fish and crab	Don't know	N
(prompt)	(No response)	
seal	They both swim under water.	S
cow	The cow eats grass, the cow gives milk but the fish doesn't	
(prompt)	The fish is a little bitty brown.	S
tree	Don't know	N
(prompt)	(No response)	
crab or tree?	(Crab) Because a tree doesn't grow under water.	S
comb	That's got a little bit of that. (comb like fin)	S
party	That's got kind of yellow candles and that's yellow.	S
names?	fish comb cow tree seal - a sealion party crab	

Alexander 10:8

Series A: pictorial presentation.

Bee and fly	They've both got the same kind of wings.	S
bird	They can both fly	S
rabbit	They've both got furry stuff	S
flower	They're coloured.	S
book	That's, when you open it up it looks as though it's got wings.	S
car crash	They both make a noise	S
names?	book fly bird two cars rabbit flower bee	

Series B: verbal presentation

Fish and crab	They both live in the water	S
seal	They both have gills	S
cow	Both can move	S
tree	The leaves have kind of scales	S
comb	A comb's got kind of scale things	S
party	You can eat a fish	R
(prompt)	(No response)	

Appendix 2:2

Non-prototypical similarities.

The following is a list of all those responses excluding category names and the spelling response to the bee-book comparison which were offered as similarities in response to simple comparison questions, which are not true of prototypical instances of at least one of the categories compared. The number of cases of such responses is also given.

	Responses	V	P	Total
Bee - fly	Stripes	1		1
	Same colour (blue)		1	1
	Sting		1	1
Bee - bird	Colour	1	10	11
	Claws		1	1
- rabbit	Colour		10	10
	Jump	1		1
- flower	Shape		1	1
	Colour		8	8
- book	Size		1	1
	Colour		6	6
- car crash	Colour		7	7
	Hind legs resemble steering wheel		2	2
	Stripes on seat resemble lines on wings		1	1
Fish - crab	Crab is larval stage of fish		1	1
	Shape	$\frac{1}{2}$		$\frac{1}{2}$
	Size	1		1
	Colour	1	$\frac{1}{2}$	$1\frac{1}{2}$
	Fins	1		1

Fish - crab (cont)	Fins same shape as crab's shell	1		1
	Parallel lines on drawings		1	1
- seal	Size		1	1
	Colour	3	1	4
	Gills	1		1
- cow	Colour	2	1	3
- tree	Shape (long)	1		1
	Colour	3	2	5
	Wrinkled	1		1
	Trunk resembles tail		1	1
	Branches resemble tail		1	1
	Leaves resemble tail	1		1
	Roots resemble tail		1	1
- comb	Size	1		1
	Colour	2	1	3
	Tail	1		1
- party	Shape (long)		1	1
	Colour	1	4	5
	Party hat resembles fin		1	1
	Balloons resemble tail		1	1
	Fish scales resemble pattern on hat		1	1
	Fish scales resemble sections of jelly		1	1
	Party hats could be fish-shaped	1		1
		$25\frac{1}{2}$	$69\frac{1}{2}$	95

Chapter 3. Further developments of Claparède's task.

Introduction.

The experiment described in the previous chapter substantially confirmed Claparède's conclusions. Two points might however be made. As mentioned in Chapter 1, it is a matter of inference that children find it easier to give similarities than differences so long as differences are never asked for directly. Secondly, the finding that it is more difficult to give similarities between more dissimilar items is not surprising, intuitively, but it could be due partly to perseveration. For both series of problems used in the previous experiment the similarities most commonly given in answer to the first two problems ('having wings' and 'flying' for the bee series and 'living in water' and 'swimming' for the fish series) were the differences most commonly given in response to the third problem. Even when a child did not give a difference, if the answer given to the earlier problems tended to occur to mind it might have inhibited a correct response. If this is the case it might be easier to take the problems in the reverse order as an answer which was correct for a more dissimilar pair might well be correct for a less dissimilar pair also.

Accordingly these two modifications, asking for differences as well as for similarities and presenting the problems sometimes in order of increasing dissimilarity and sometimes the reverse, are introduced to the procedure used in the experiment reported in this chapter. Verbal presentation only is used, as pictorial presentation was explored in the previous chapter and it had certain disadvantages, such as the necessity to choose easily portrayable items, although this did not eliminate uncertainty as to how the pictures were identified by the subjects, and the children's tendency to give trivial similarities or category names in response. One other disadvantage of pictorial presentation, that events can only be portrayed by portraying the objects participating in them, is irrelevant to the present study as they are not included in the problems used. Comparisons involving events were found to be extremely difficult and they might well be disconcerting if presented first in a series of problems increasing in similarity between the items compared.

Asking for differences raises a difficulty in the phrasing of the question. The obvious forms corresponding to those used for similarities are 'What's different about A and B?' and 'Can you tell me something that's different about A and B?' The difficulty with this is that it is known that some pre-school children respond to 'different' much as they do to 'same' (Donaldson and Wales 1970). Using 'not the same' in place of 'different' might be thought an improvement but 'What's not the same about A and B?' does not trip off the tongue so readily and may raise problems associated with negative sentences. Negative sentences are not used naturally without some reason (Wason 1965) and questions employing them might appear as trick questions. In general, it cannot be assumed that a question using 'not the same' is equivalent to one using 'different'. As most of the development in handling Claparède's task occurs within the school age range it seems better to use this age group and employ the simple form of question with 'different'. Although children of this age might be expected to interpret 'different' correctly some assessment of their understanding will be necessary.

There are two predictions concerning the results of this experiment corresponding to the two modifications introduced.

1. Differences are easier to give on demand than similarities.

There are possible exceptions to this prediction. It was suggested in the previous chapter that the tendency to give differences when similarities were requested might be a result of comparisons being made across basic level categories. If a comparison was between two members of the same basic level category it might be easier to give a similarity than a difference between them, and a similarity might be given in answer even when a difference was requested. In this experiment the bee-wasp comparison dropped from Claparède's series previously is reinstated and other comparisons between very similar items are also used. These comparisons might be within basic level categories, at least for the younger subjects.

2. It is easier to give similarities when problems are presented in order of increasing, rather than decreasing, similarity, the reverse being true for differences.

In general the findings of the present experiment are expected to be similar to those of the previous one. If it is easiest to give similarities between the most similar pairs of items it might be expected to be easiest to give differences between the most dissimilar pairs. However it seems intuitively to the writer that any comparison, whether of similarity or of difference, might be easier when made between similar items, so no prediction is made concerning this. The content of the children's answers will not be examined at as much length as in the previous chapter, but similarities and differences will be compared.

Method.

Subjects.

The subjects were 63 children falling into three age groups as follows:

Group	No. of subjects	Age range	Mean age
J1	23	4 yrs 9 mo - 6 yrs 3 mo	5 yrs 8 mo
J2	20	6 yrs 3 mo - 8 yrs 2 mo	6 yrs 10 mo
J3	20	7 yrs 1 mo - 8 yrs 10 mo	7 yrs 10 mo

The three groups consist of three classes of an independent school. All children present in these classes were tested. A 21st subject in J3 was tested but his responses are not included as he was not a native English speaker and appeared to have difficulty in understanding the task.

Materials.

There were four series of problems, each consisting of comparisons of one standard item with six other items. The items follow, the standard being given on the left in each case.

Series A		B		C		D	
Bee	Wasp	Orange	Lemon	Daisy	Buttercup	Crab	Lobster
	Fly		Apple		Bluebell		Starfish
	Bird		Potato		Tree		Goldfish
	Rabbit		Daffodil		Mushroom		Dog
	Rose		Butterfly		Sparrow		Grass
	Stone		Brush		River		Sun

Method.

Each child was tested individually in a caravan parked in the school grounds. All four series of problems were presented to each child, similarities being requested for two of them and differences for the other two and two being given in order of increasing dissimilarity and two the reverse. Both series with one instruction ('same' or 'different') were presented before either with the other instruction and the order of 'increasing' and 'decreasing' conditions was kept the same for both instructions, giving rise to four possible orders for the various conditions. As there are 24 possible orderings of series A - D there are 96 combinations of materials with conditions altogether and a different one was chosen at random for each subject. Instructions and prompts were given as for the experiment described in the previous chapter, with the substitution of 'different' for 'the same' where appropriate.

Results.

Sample protocols.

Appendix 3:1 contains three sample protocols, one from each age group, which give some idea of the quality of testing sessions. Colin, the youngest child, is one of the poorer performers generally and (to anticipate) appears to think that 'different' means 'same'. Victoria, in J2, falls at about the median in terms of correct answers and William, the oldest subject to be included in the appendix, is one of the better performers to be tested.

Number of problems attempted.

As with the previous experiment, not all children attempted all problems. The mean scores and ranges for numbers of problems attempted by the different age groups are given in Table 3:1.

	Same		Different		Total	
	Mean	Range	Mean	Range	Mean	Range
J1	11.1	9 - 12	11.5	6 - 12	22.6	16 - 24
J2	11.7	11 - 12	12.0	12	23.7	23 - 24
J3	11.7	11 - 12	12.0	12	23.7	23 - 24
Overall	11.5		11.8		23.3	

Table 3:1. Number of problems attempted.

The number of problems attempted was generally high. In all, 39 subjects, or 62% of the total, took all 24 problems, this number being made up of 12 from J1 (52%), 13 from J2 (65%) and 14 from J3 (70%).

The age effect for number of problems attempted is statistically significant only for the 'different' problems: Kruskal-Wallis one-way analysis of variance, 'same' problems, $H = 3.77$, $df = 2$, n.s., 'different' problems, $H = 7.30$, $df = 2$, $p < .05$. Obviously this is a difference between the youngest group and the other two, and a significant result was only obtained because there is no variance within the older two groups.

Of the 24 subjects who did not attempt all 24 problems, 21 took more 'different' problems than 'same' ones, one the reverse and two took the same number for each.

Words not known by the subjects.

Unfortunately there are some problems which were administered to the children which were effectively not taken by them because they did not know the words for one of the involved items. The numbers of such cases are given in Table 3:2. As can be seen the only serious problem arises with series 4 but then it is serious indeed. Over a third of all the children, and half of those in J1, did not know the term 'lobster'. One child in J2, after not responding throughout series 4,

		J1	J2	J3	Total
Series 1	Rose	1	-	-	1
Series 2	Lemon	-	1	-	1
Series 3	Bluebell	-	-	1	1
Series 4	Crab	-	1	-	1
	Lobster	12	8	3	23
	Starfish	3	1	-	4

Table 3:2. Numbers of children ignorant of certain words.

was found not to understand the word 'crab'! If instances in which a term was not understood are also counted as problems not taken, the number of subjects attempting all 24 problems is reduced to 30, or 48% of the total, made up of 7 children in J1 (30%), 10 in J2 (50%) and 13 in J3 (65%).

Number of correct responses by instruction and order of problems.

As in the previous chapter, the subjects' responses were classified as similarities, differences, relations and no responses. The effects of the new modifications introduced in this chapter, asking for differences as well as similarities and presenting the problems in order of both increasing and decreasing similarity will be considered first. Figure 3:1 shows the proportions of the different kinds of answer given and indicates that 'different' problems were much easier than 'same' ones. Of the 30 subjects taking all 24 problems, 26 obtained a higher score for the 'different' problems, 3 scored 100% on both 'same' and 'different' problems and 1 scored 12/12 for 'same' and 11/12 for 'different'. Taking into account all 63 subjects and using the proportion of problems attempted which were appropriately answered as the measure, 58 children perform better on the 'different' problems than on the 'same' ones and in addition to the four exceptions noted above, one child scored zero on both types of problem.

It is clear that 'different' problems are much easier than 'same' ones overall but the question of whether or not this is true for the most similar pairs is still to be addressed. Figure 3:2 shows the proportions of correct responses for the various problems. It seems to have been easier to give a similarity than a difference in answer to two problems, A1 (bee-wasp) and D1 (crab-lobster). The bee-wasp comparison was attempted by almost all subjects. Twenty-eight subjects out of the 30 who attempted it as a 'same' problem or 93% were

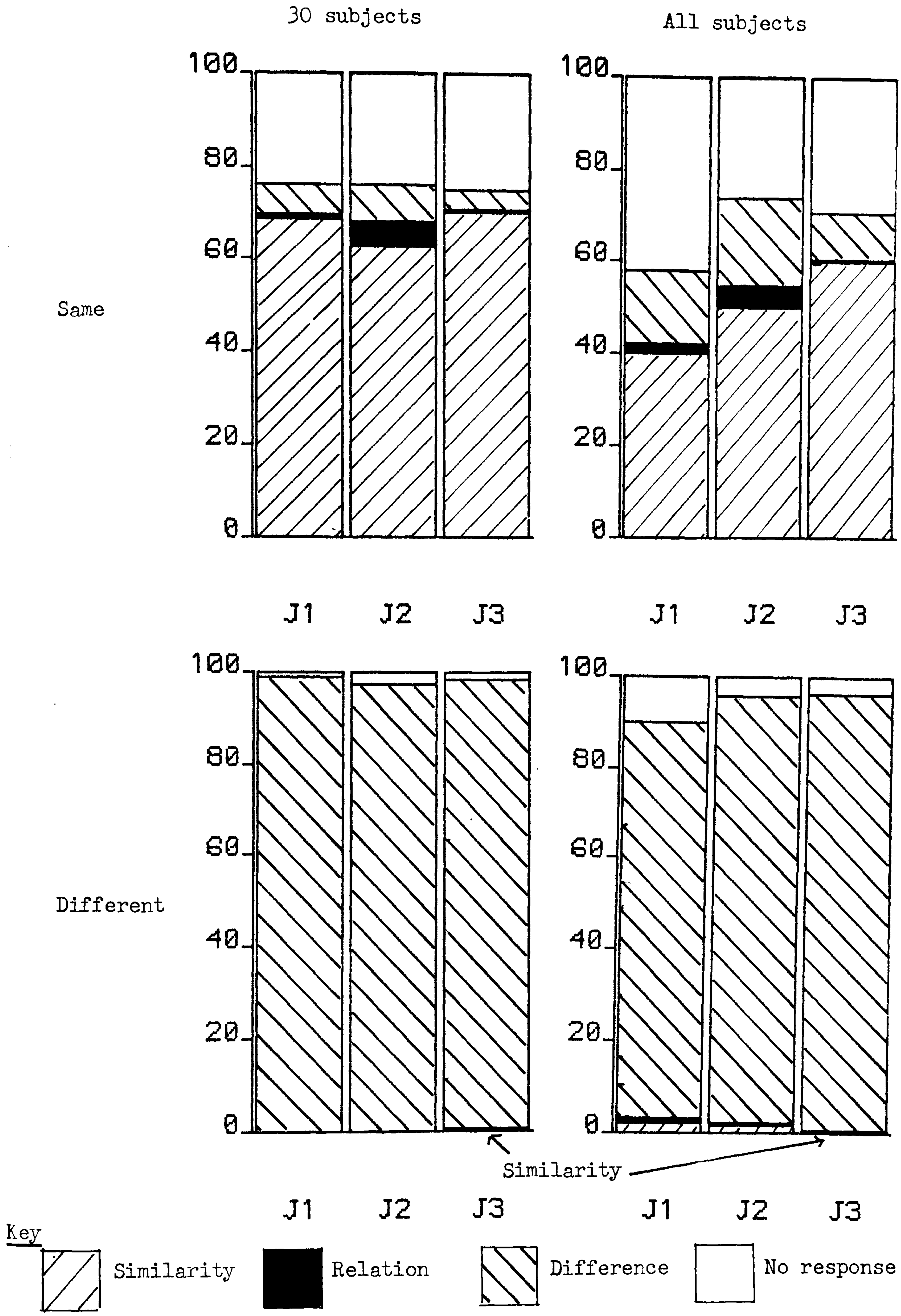
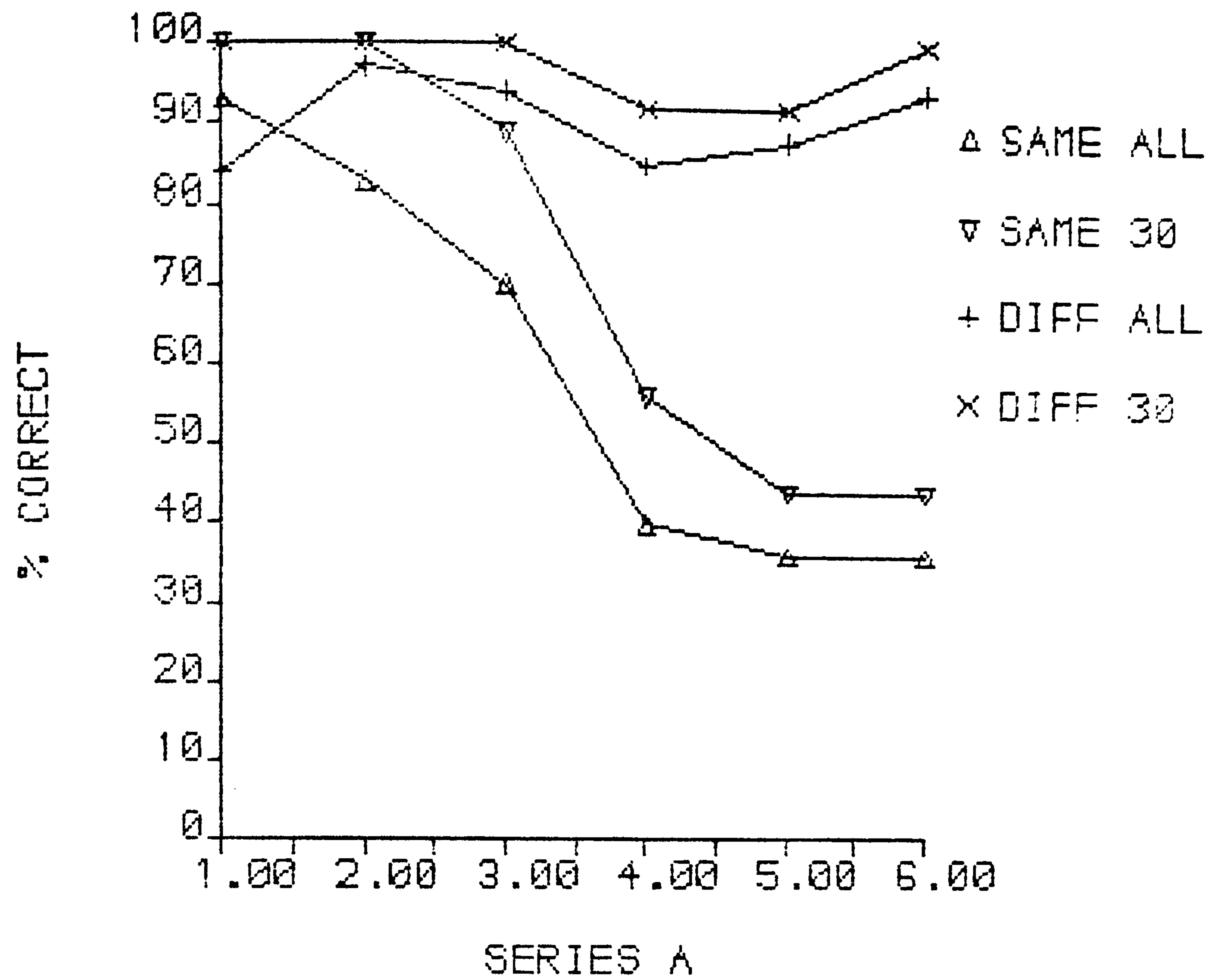
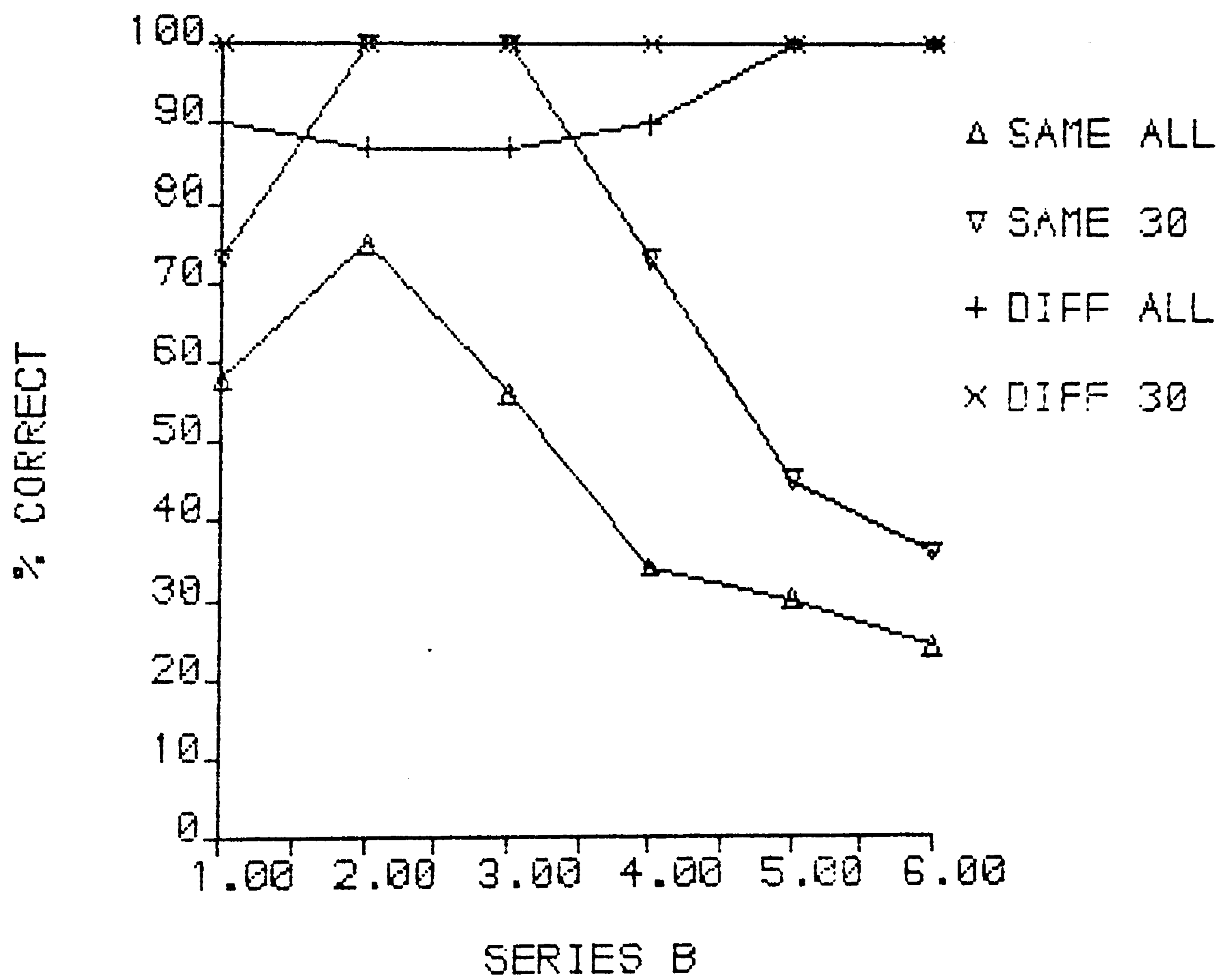


Figure 3:1. Percentages of responses falling into different categories.





<u>Figure 3:2</u> (continued over)

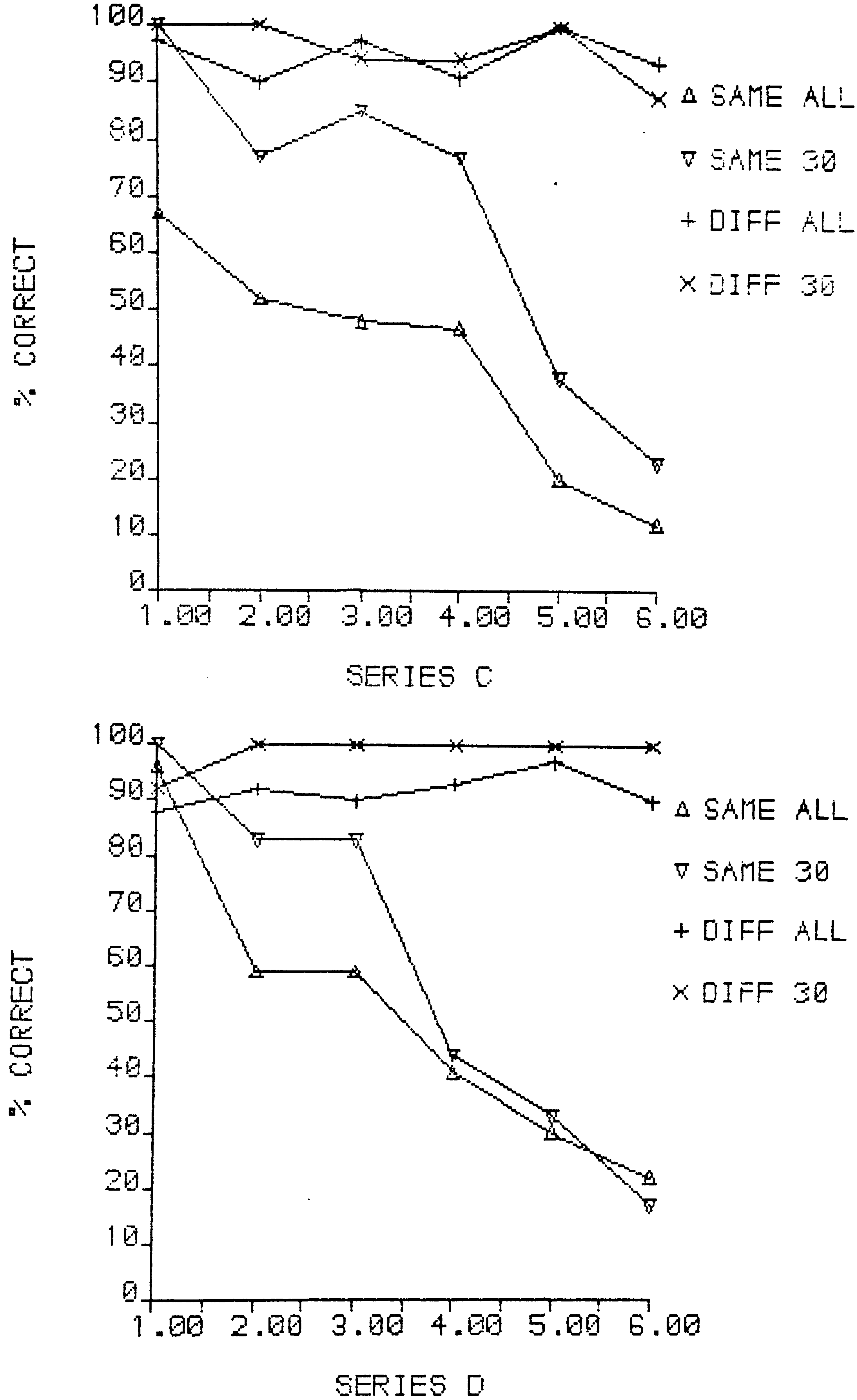


Figure 3:2. Percentage correct responses to the different problems, for all subjects and for subsample.

successful in giving a similarity compared with 26 out of 31, or 84%, as a 'different' problem. The percentage of correct responses is higher for similarities in all three age groups but even the difference between the totals is not large enough to be statistically significant. Fewer children attempted the crab-lobster comparison. In this case 22 out of 23 or 96% were successful in giving similarities and 15 out of 17 or 88% gave differences on request, this difference being entirely due to a difference in J3. Only for one other age group/problem combination is there any evidence for similarities being easier and there the difference is negligible. Eight out of 13 children in J1, or 62%, give similarities between an orange and an apple (problem B2) on request compared to 6 out of 10 for differences.

The question of whether it is easier to take the problems in order of increasing or decreasing similarity for each instruction can only be assessed using the group of 30 subjects who took all 24 problems as those not attempted by the other subjects would be likely to differ in difficulty between increasing and decreasing series. Table 3:3 gives the mean number of correct responses (i.e. similarities for 'same' problems and differences for 'different' problems) made by this group in the different conditions and the results of Wilcoxon matched pairs signed - ranks tests on the differences between the conditions.

	Increasing dissimilarity	Decreasing dissimilarity	N	T	Z	(1-tailed) p
Same	3.8	4.3	17	32.5	-	< .05
Different	6.0	5.8	5	0	2.02	< .05

Table 3:3. Mean number of correct responses by condition and results of Wilcoxon tests.

The usual tables for the Wilcoxon test (e.g. Siegel 1956) require a minimum N of 6 while in this case only 5 children failed to score 100% on both 'different' series. The method of testing significance for large samples, using a Z score, was therefore used as this is said to be a good approximation even for small samples (Siegel op. cit.). It does then seem that as predicted it is easier to take 'same' problems in order of decreasing dissimilarity and 'different' problems in order of increasing dissimilarity.

Understanding of 'different'.

At this point the possibility that 'different' problems appear to be easier than 'same' ones because of a misunderstanding will be considered. As mentioned in the introduction to this chapter young children (typically those younger than the ones employed in this study) tend to respond to 'different' as if it means 'same'. When asked to give similarities children quite often give differences, as found by Claparède and in this study and the one reported in the previous chapter, the extent of this tendency being underestimated by the results as presented in this work as some similarities were given after the experimenter had rejected differences. It might be that some children, hearing a request for something 'different', believe they have been asked for something 'the same' and then give a difference because that is their wont when asked for a similarity, and thus there is a case of two wrongs apparently making a right. In Appendix 3:2 to this chapter the evidence for the children's understanding of 'different' is considered, giving the conclusions shown in Table 3:4.

	J1	J2	J3	Total
Understand 'different'	16	20	19	55
Treat 'different' as 'same'	3	0	1	4
Other	4	0	0	4
	23	20	20	63

Table 3:4. Numbers of subjects who do and do not understand 'different'.

The children classified as 'other' are those who cannot certainly be said to fall into either of the other two categories, and may fall into neither of them, because they do not understand 'different' but do not treat it as if it meant 'same'. Even if all eight children who do not obviously have a correct understanding of 'different' treat it as meaning 'same' this is not sufficient to account for the difference in difficulty between 'same' and 'different' problems actually obtained.

We may now consider whether various findings reported in the previous chapter are repeated here.

Age and number of correct responses.

Firstly, it might be expected that the older children would give more correct responses than the younger ones. Figure 3:1 suggests a small age effect for the whole group but not for the subsample of 30 subjects. The small size of the latter sample makes it more susceptible to the influence of individual subjects and it also includes a more highly selected group of younger children than of older ones, which would be likely to diminish any age effect. In order to test for age effects, Kruskal-Wallis analyses of variance were performed on the whole sample, using proportion of attempted problems correctly answered as the measure, and on two separate subsamples, those who had taken all 'same' problems and those who had taken all 'different' problems as appropriate. Table 3:5 gives the outcome of these analyses.

		H	df	p
Same	36 subjects (11 J1, 11 J2, 14 J3)	0.94	2	n.s.
	All subjects	7.61	2	<.05
Different	46 subjects (13 J1, 17 J2, 16 J3)	1.17	2	n.s.
	All subjects	2.74	2	n.s.

Table 3:5. Results of Kruskal-Wallis analyses of variance for age effects on number of correct responses.

So only for the whole sample and for 'same' problems is there a statistically significant age effect. There is probably a ceiling effect for 'different' problems and the use of the subsample of 36 taking all 'same' problems is subject to the difficulties outlined above.

Problems not attempted by all subjects.

The one significant age effect found is only meaningful if the problems taken by the younger children are not, on average, more difficult than those taken by the older subjects. This can only be assessed if it is known which problems are omitted and how relatively difficult they are. The former information is given in Table 3:6.

	Level of dissimilarity					
	1	2	3	4	5	6
Same	91	99	99	98	94	80
Different	88	94	99	99	97	98

The problems in each series are numbered from 1 (most similar) to 6 (most dissimilar)

Table 3:6. Percentage of problems at each level of similarity attempted by subjects as a whole.

For 'same' problems it is, if anything, the more dissimilar pairs which are not attempted, though the effects of problems omitted because of unknown words and the two different orders of presentation make this much less striking than in the previous experiment. For 'different' problems it tends to be the most similar pairs which are not attempted.

Difficulty of problems by level of similarity.

Figure 3:2 shows the proportion of correct responses given to the different problems both for the whole sample and for the subsample of 30 subjects. The latter group performs somewhat better but otherwise there is not much difference between the two groups. Spearman rank correlation coefficients between the level of similarity and degree of difficulty of the problems summed over all 4 series are presented in Table 3:7. The correlations are computed for the subgroup of 30 subjects to provide a set of coefficients which are comparable with each other but also on all subjects who attempt all problems in the appropriate series as a form of check on the representativeness of the former sample. The two sets of correlations are similar (except for the 'different; decreasing' condition, where all 30 subjects in the smaller sample score 100%) which increases confidence. The more similar pairs are easier to find similarities for than the less similar, as expected, while for differences it makes no difference.

Unsurprisingly it seems that the problems more likely to be omitted are the more difficult ones, if anything. The age effect previously reported is then an underestimate rather than otherwise as the problems taken by the younger children are easier, on average, than those taken by the older ones.

	30 subjects		All subjects completing series	
	r_s	p	r_s	p
Same, decreasing similarity	- .72	<.001	- .86	<.001
Same, increasing similarity	- .83	<.001	- .83	<.001
Different, decreasing similarity	0	n.s.	.39	n.s.
Different, increasing similarity	- 0.09	n.s.	.07	n.s.

Tests on 'same' series are 1-tailed, those on 'different' series are 2-tailed.

Table 3:7. Spearman rank correlation coefficients on level of similarity and degree of difficulty.

Differences given when similarities were requested and vice versa.

The previous experiment found that some children gave both similarities and differences in answer to 'same' questions and that, not surprisingly, these children gave the similarities in answer to the easier problems, that is, the more similar pairs. In this experiment 30 children gave both similarities and differences in responding to 'same' problems and as some did so in both the increasing and the decreasing conditions, there are in all 42 series of answers containing both similarities and differences. Of these, 22 had all the similarities given to more similar pairs than any of the differences, 18 were mixed and 2 had all the differences given to the more similar pairs.

In the present experiment there is of course also the possibility of giving similarities in answer to 'different' questions, though such answers were less common than the reverse case, even as a proportion of errors. Of answers to 'same' questions, 15% of the total and 30% of the errors (i.e. the non-similarities) are differences, while only 1.5% of the responses and 20% of errors given to 'different' questions are similarities. Eight subjects each produced one series of answers containing both similarities and differences. Five of these had all the similarities given to more similar pairs than any of the differences and the other three were mixed. This is not statistically significant using a 2-tailed sign test and although the direction of the result is extremely plausible it was not specifically predicted.

As only eleven similarities were given when differences were requested it is possible to examine them in more detail. Four of them were given by one child, who was one of those who did not clearly understand 'different' and may have believed similarities were expected. The remaining seven were given by seven different children, two in J1, four in J2 and one in J3, all of whom did understand 'different'. Three of their similarities were to the same problem: the bee-wasp comparison. This is some evidence that this comparison may be within a basic level category for some subjects. Six of the seven were given when the problems were taken in order of increasing similarity, and four of these cases seem to be instances of perseveration, an answer such as 'black and yellow stripes' which has previously been a difference being persisted in even when no longer correct. The one similarity given when the problems were presented in order of decreasing similarity was to the first 'different' question asked, following the 'same' problems and so also hints at perseveration.

Responses to binary comparisons.

Claparède reported that binary comparison questions were easier to answer than simple ones and the study described in the previous chapter supported this. The same is found here, for answers to 'same' questions: 31 subjects found the binary comparisons easier and only 18 the simple ones, this difference being statistically significant (sign test, $Z = 1.71$, $p < .05$). Only eight children answered binary comparison 'different' questions, and these only answered one to three each, and there is no indication whether or not they are simpler than the corresponding simple questions.

Relations.

As in the previous study, a small number of responses fell into the category of relations, as shown in Table 3:8. The subjects who give relations in answer to 'different' problems are not among those who give them in answer to 'same' problems. Also as in the previous study, these answers are not evenly distributed across problems, as Table 3:9 indicates.

	Same		Different	
	No. of subjects	No. of relations	No. of subjects	No. of relations
J1	4	4	1	3
J2	7	11	1	1
J3	1	1	0	0
Total	12	16	2	4

Table 3:8. Number of subjects giving relations and number of relations given.

Problem	No. of relations Same	Different	Total
Bee - bird	0	1	1
Bee - rabbit	1	1	2
Bee - rose	5	0	5
Bee - stone	1	1	2
Orange - butterfly	1	0	1
Daisy - sparrow	1	0	1
Daisy - river	4	0	4
Crab - starfish	1	0	1
Crab - dog	1	0	1
Crab - sun	1	1	2
Total	16	4	20

Table 3:9. Number of relations given by problem.

Analysis by content of answers.

Tables 3:10, 3:11 and 3:12 show the similarities given when requested, the differences given when requested and the differences given when similarities were requested classified according to similar general categories to those used in the previous chapter. There were too few similarities given when differences were requested to make tabulating them a useful exercise. Similarly the answers are not categorised separately for each problem as the numbers of responses given to many of the problems are rather small.

		Category names	Physical properties	Motion	Common part	Similar part	Habitat	Other	
J1	No.	3	48	6	25.5	-	1	18.5	102
	%	3	47	6	25	-	1	18	
J2	No.	2	31.5	12	28.5	2	17	18	111
	%	2	28	11	26	2	15	16	
J3	No.	10	51.5	19.5	22	7	17.5	14.5	142
	%	7	36	14	15	5	12	10	
Total	No.	15	131	37.5	76	9	35.5	51	355
	%	4	37	11	21	3	10	14	

Table 3:10. Content of similarities given when requested.

If Table 3:10 is compared with the figures given in Table 2:8 for verbal presentation, to which it corresponds, it can be seen that physical properties were given more often, and answers citing motion and similarity of parts less often, than previously. The difference in the motion category is probably due to the different content of the problems but reasons for the other differences are not clear. Apparent differences between the age groups are difficult to assess because the contributions made by particular problems are not consistent. However there is no evidence of the decline with age of answers citing physical properties which was found previously.

		Category names	Physical properties	Motion	Different parts	Habitat	Other	
J1	No.	4.5	139.33	16	30.33	3	28.83	222
	%	2	63	7	14	1	13	
J2	No.	8.83	100	19.83	43	3.5	46.83	222
	%	4	45	9	19	2	21	
J3	No.	20	88	24	38	7	50	227
	%	9	39	11	17	3	22	
Total	No.	33.33	327.33	59.83	111.33	13.5	125.67	671
	%	5	49	9	17	2	19	

Table 3:11. Content of differences given when requested.

		Category names	Physical properties	Motion	Different parts	Habitat	Other	
J1	No.	-	35.5	1	6	1	10.5	54
	%	-	66	2	11	2	19	
J2	No.	1	31	2.25	18.25	2	20.5	75
	%	1	41	3	24	3	27	
J3	No.	2	16.5	4	4.5	2	5	34
	%	6	49	12	13	6	15	
Total	No.	3	83	7.25	28.75	5	36	163
	%	2	51	4	18	3	22	

Table 3:12. Content of differences given when similarities were requested.

In tables 3:11 and 3:12 a single category 'different parts' replaces 'common part' and 'similar part'. Almost all answers included in this category asserted that one item had a part which the other lacked, such as Victoria's 'A mushroom has not got petals' and other answers. Most answers comparing the parts of items such as Victoria's 'A daisy has got white petals and a buttercup has got yellow' are included in the physical properties category but there are a few exceptions, for instance a comparison of the crab's claws with the sun's beams, which fall under the heading of different parts.

The proportions of responses falling into the various categories in Tables 3:11 and 3:12 are very similar. Physical properties stand out even more than they do for similarities, half the responses falling into this category. Table 3:11 suggests that for differences these answers do decline in importance with age.

Physical properties further considered.

As the category of physical properties accounts for such a large proportion of the answers given in this study it is worthwhile to examine it further. Almost all the answers in this category cited the properties colour, shape and size although others such as pattern and hardness were also mentioned. Table 3:13 shows the numbers and proportions of similarities and differences given on request which refer to colour, shape and size.

	Similarities				Differences			
	J1	J2	J3	Overall	J1	J2	J3	Overall
Colour	20(20)	11(12½)	13(18½)	14(51)	34(74⅚)	27(60½)	19(42)	26(177⅓)
Shape	25(26)	14(15½)	18(25)	19(66½)	3(6)	4(9)	8(17½)	5(32½)
Size	1(1)	2(2½)	3(4)	2(7½)	24(53½)	12(26½)	10(22½)	15(102½)
Total	46(47)	27(30½)	33(47½)	35(125)	61(134⅓)	43(96)	36(82)	47(312⅓)

Figures given are percentages of responses made by the group in question, with the absolute number of responses in parentheses.

Table 3:13. Responses citing colour, shape and size.

Size is rarely cited as a similarity and shape as a difference while colour is quite commonly mentioned as both, but especially as a difference. It is surprising that these three properties should account for a higher proportion of differences than of similarities as a greater variety of differences was offered by the children - an average of 9.4 appropriate differences per problem, compared with only 6.0 appropriate similarities. This greater variety is probably just a result of the larger number of correct responses given to 'different' problems, but it does highlight the concentration on physical properties.

Discussion.

It is clear from the results of this experiment that the children find it very much easier to give differences between items on request than to give similarities. Indeed, giving differences is so easy that the children do so for over 90% of the 'different' problems they attempt and this very high level of performance makes it difficult for any effects of age, condition (increasing versus decreasing similarity) and so on to make themselves felt. Consequently it is impossible to determine in any instance whether the lack of an effect is due to the near ceiling performance, or whether there would be no such effect in any case.

Two problems, the bee-wasp and crab-lobster comparisons, elicited a higher proportion of similarities on request than of differences. This is taken as evidence, though certainly not conclusive evidence, that these pairs of items are each members of the same basic level category for at least some of the subjects. The bee-wasp comparison was the only problem to elicit more than one similarity when a difference was requested and this strengthens the case that this comparison is often within a basic level category. No similarities were given for the crab-lobster comparison when presented as a 'different' problem.

In general differences offered appear to be similar to similarities in content, though general physical properties were more commonly given as differences. This was especially true for colour and size, while shape was more commonly given as a similarity. The differences cited did not vary in their content whether given when requested, or in error when the question asked for a similarity.

As for the other manipulation introduced in this chapter it turns out that as hypothesised it is easier to give similarities between items if the problems are presented in order of increasing similarity rather than the reverse, while the converse is true for differences.

Other than these results, the findings reported in this chapter are much the same as those of the previous one and those reported by Claparède (1918). Age effects are scarce: it has already been noted that if only children who attempt all problems are considered they are most highly selected from the younger children whereas if the whole sample is employed the younger children's answers are averaged over easier problems than those of the older ones, both these tending to depress any age effect in the data, and there is also the ceiling effect for 'different' problems. It only remains to be noted here that there is a considerable overlap in age between J2 and J3 and this may also have an influence in lessening any difference between the groups of different average age.

The findings of this and the previous experiment enable a description of what occurs when a child is asked to compare two items to be attempted.

Firstly it seems to make a difference whether or not the items are instances of the same basic level (b.l.) category for the child. This is suggested by the particular easiness of the bee-fly comparison found in the previous experiment and the findings concerning the bee-wasp comparison in this one. As suggested in the previous chapter, if a similarity is asked for between two items which are members of the same b.l. category then the child will effectively conceive of them as identical and rather than having to abstract a property common to two categories, simply cites a property of one. If the items to be compared are not instances of the same b.l. category then the child does have to find a property common to two items which he conceives of differently. That is, he has to unite them in some common category, even if it is only defined by the characteristic he cites as a similarity. This common category is in no way given to him: he must create it. It seems to be more difficult to create such a category if the items are more dissimilar: this may well be because of the remoteness of it from the basic level, or it could simply be because there are fewer similarities and therefore fewer possible common categories.

If the child is asked for a difference between items which he conceives of differently, i.e. which are members of different b.l. categories for him the problem is again very easy as the answer arises directly from his way of thinking of the items. It is more difficult if the items are members of the same b.l. category but it is reasonable to suppose that it is still easier than finding a similarity across b.l. categories because the appropriate categories are given to him, defined by the terms naming the items, and he does not have to create them for himself. Since most 'different' comparisons required were certainly across b.l. categories it is not surprising that no differences in level of difficulty due to degree of dissimilarity were found.

This account suggests why binary comparisons should be easier than simple ones. If a child is asked whether A is more like B or C, various properties distinguishing B from C are likely to come to mind. He has then only to find a category defined by one of these properties of which A is a member. Effectively, binary comparison questions are hints as to the common category to be formed between two items.

Taking the 'same' problems in order of increasing similarity rather than the reverse may be easier for a similar reason, at least in part. If a child has compared, for instance, a bee and a stone and is then asked to find a similarity between a bee and a rose he may be able to use an implicit binary comparison and look for something uniting the bee and the rose and distinguishing them both from the stone. This is much more likely to succeed than if he were going in the opposite direction and, say, looking for something in common between a bee and a fly in which both differ from a wasp. In this case, if asked for a difference, remembrance of the wasp could enable the child to think of some common property between the bee and the wasp, distinguishing them from the fly. In general this is less likely to be of help than the corresponding process with similarities as it is likely to be easier to give a difference directly than by the intervention of a similarity.

Not every response given by the children in these experiments is in conformity with the above account but this should probably not be expected. It does not predict any errors for 'different' comparisons across b.l. categories, and the few similarities given in such cases are quite unaccountable effects of the usual variability of young children's performance. 'No responses' to 'different' comparisons may be the result of the children having incomplete entries for some of their concepts, so that both items in a comparison are never ascribed different values for the same property. This is hinted at by answers such as Colin's 'Because the starfish is brown and the crab is bigger' which occur occasionally in the data. Perhaps his concept of a starfish is marked with a value for colour and not size and vice versa for a crab, or only these properties are momentarily accessible. Most children attempted to cite a contrast with respect to a single property and a child who could not find such a contrast but was unwilling to offer a compound answer such as Colin's would be forced into a 'no response'.

The results suggest a degree of inflexibility in the children's thinking. There is a notable tendency to try to use the same property e.g. colour, throughout a series of problems and sometimes throughout more than one series. This is an economical strategy where effective but sometimes leads to error. This phenomenon was given as a reason for predicting that it would be easier to take similarity comparisons in order of increasing similarity and different comparisons in the reverse order, and it may be the only reason why the decreasing order is easier for differences.

The children also seem to be dominated to a considerable degree by the properties colour, shape and size. Many of the similarities citing these are tenuous, such as that an orange is orange, a lemon is yellow and orange and yellow match, or that an orange is round and a brush's handle is round. Shape was mentioned more commonly as a similarity than a difference, possibly because it is seen as an essential characteristic of an object and the children reasoned that if the experimenter believed there to be some similarity between the items there must be a similarity of shape. Colour and size, on the other hand, are common distinguishing features between objects which are basically of the same type (and consequently of the same or similar shape).

This kind of inflexibility and domination by a few properties, and the tendency to give differences when similarities are asked for, and also, rarely, the converse, suggest that the children are not always in active control of their thought processes. These processes seem to have a momentum of their own which leads to the production of the more blatant errors. Learning to direct the contents of their own awareness would not in itself lead the children to perfect performance but would enable them to avoid the mysterious errors of early childhood.

Appendix 3:1. Sample protocols.

Colin 5:6 J1

Same - decreasing similarity

Orange	Lemon	(NR)	N
	(Prompt)	(NR)	
	Apple	(NR)	N
	(Prompt)	(NR)	
Lemon or	Apple	(Lemon) Because it's sour. (Is an orange sour?) No.	D
	(Prompt)	(NR)	
	Potato	(NR)	N
Apple or	Potato	(Potato) Because the orange is juicy. (And a potato?) Because the potato is plain	D
	(Prompt)	(NR)	
	(Daffodil)	(NR)	N
	(Prompt)	(NR)	
Lemon or Daffodil?		(Daffodil) Because it's plain, because you can't eat it.	D

Same - increasing similarity

Daisy	River	(NR)	N
	(Prompt)	(NR)	
	Sparrow	(NR)	N
	(Prompt)	(NR)	
River or	Sparrow	(Sparrow) (NR)	N
	(Prompt)	(NR)	
	Mushroom	(NR)	N
	(Prompt)	(NR)	

River or	Mushroom?	(Mushroom) (NR)	N
	(Prompt)	(NR)	
	Tree	(NR)	N
	(Prompt)	(NR)	
Sparrow or	Tree?	(Tree) Because the tree, of the tree trunk is brown. (And a daisy?) Because the daisy is yellow.	D
	(Prompt)	(NR)	
	Bluebell	(NR)	N
	(Prompt)	(NR)	
	Buttercup	(NR)	N
	(Prompt)	(NR)	
Buttercup or	river?	(Buttercup) Because the buttercup is blue.	D
	(Prompt)	(NR)	

<u>Different - decreasing similarity</u>.

Bee	Wasp	Because the bee is smaller and the wasp is a wee bit bigger.	D
	Fly	(NR)	N
	(Prompt)	(NR)	
	Bird	Because the bird is big and the bee is small.	D
	Rabbit	(NR)	N
	(Prompt)	(NR)	
Fly or	rabbit?	(Rabbit) 'Cos the rabbit is big and the bee is small.	D
	Rose	(NR)	N
Fly or	rose?	(Rose) Because the rose is big and the bee is small.	D
	Stone	Because the bee is small and the stone is big.	D

Different - increasing similarity.

Crab	Sun	'Cos the crab is small and the sun is bigger than the crab.	D
	Grass	'Cos the grass is small and the crab is big, sometimes.	D
	Dog	Because the dog is bigger and the crab is smaller.	D
	Goldfish	The crab is bigger and the goldfish is smaller.	D
	Starfish	Because the starfish is brown and the crab is bigger.	D
	Lobster	Because the lobster's big and the crab is a wee bit smaller.	D

Victoria 6:11 J2

Different - increasing similarity.

Orange	Brush	The or - the brush has got spikes and an orange hasn't.	D
	Butterfly	A butterfly can fly but an orange can't.	D
	Daffodil	A daf - a daffodil's got a stem but a orange hasn't.	D
	Potato	Orange is more rounder than that and a potato grows up in the ground.	D
	Apple	An apple is green and a orange is orange.	D
	Lemon	A lemon is like that (indicating shape) but an orange is completely round.	D

Different - decreasing similarity.

Daisy	Buttercup	A daisy has got white petals and a buttercup has got yellow	D
	Bluebell	A bluebell is more bigger than a daisy.	D
	Tree	A daisy's much more smaller than a tree.	D
	Mushroom	A mushroom has not got petals.	D
	Sparrow	A sparrow can fly but a daisy can't.	D
	River	A river is blue and a daisy isn't.	D

Same - increasing similarity.

Bee	Stone	(NR)	N
	(Prompt)	(NR)	
	Rose	(NR)	N
	(Prompt)	(NR)	

Stone or	rose?	(Stone) Cos it's more smaller. (i.e. bee and stone are similarly small.)	S
	Rabbit	(NR)	N
Rose or	rabbit?	(Rabbit) Because - (rose) (NR)	N
	Bird	They can both fly.	S
	Fly	They can both fly and they're both small.	S
	Wasp	They both make honey.	S

<u>Same - decreasing similarity</u>

Crab	Lobster	Both have got things that they hurt people with.	S
	Starfish	They've both got eight legs, well they've both got lots and lots of legs.	S
	Goldfish	They both live under water.	S
	Dog	(NR)	N
	(Prompt)	(NR)	
	Grass	(NR)	N
	(Prompt)	(NR)	
Dog or	grass?	(Grass) Because it's smaller	S
	Sun	(NR)	N
	(Prompt)	(NR)	
Dog or	sun?	(Dog) 'Cos they both live on the ground.	S

William 7:9 J3

Different - decreasing similarity.

Orange	Lemon	An orange is orange and a lemon is yellow.	D
	Apple	An orange is orange and an apple's green.	D
	Potato	An orange is orange and a potato is yellow.	D
	Daffodil	A daffodil's a flower and an orange is a fruit.	D
	Butterfly	A butterfly is something that flies and an orange is a fruit.	D
	Brush	A brush is something you comb your hair with and an orange is a fruit.	D

Different - increasing similarity.

Bee	Stone	A bee flies, a stone doesn't.	D
	Rose	A bee flies, a flower doesn't.	D
	Rabbit	A bee flies, a rabbit doesn't.	D
	Bird	A bee is smaller than a bird.	D
	Fly	A bee takes honey from flowers and a fly doesn't.	D
	Wasp	A bee takes honey from flowers and a wasp doesn't.	D

Same - decreasing similarity.

Crab	Lobster	They both live in the sea	S
	Starfish	They both live in the sea.	S
	Goldfish	They both live in the sea.	S
	Dog	A crab's got a body, so has a dog.	S
	Grass	They're both near the sea.	S
	Sun	(NR)	N
	(Prompt)	(NR)	

Same - increasing similarity.

Daisy	River	They're lots of, they're both, they're both in lots of places.	S
	Sparrow	They're both small.	S
	Mushroom	They're both small.	S
	Tree	They're both plants.	S
	Bluebell	They're both flowers.	S
	Buttercup	They're both flowers.	S

Appendix 3:2. Understanding of the term 'different'.

In order to perform successfully in the task employed in this chapter the subjects must understand the instructions and in particular the terms 'same' and 'different'. It is assumed that the similarity question is understood but such an assumption would seem unwarranted in the case of the difference comparison question. Evidence for the children's understanding based simply on their scores in the current task, rather than the original protocols, is unclear. The experimenter prompted subjects who gave differences in answer to similarity questions but not to difference questions and vice versa for similarities, and this is likely to affect their subsequent behaviour. As it happens, each of the subjects also performed one of two further tasks, and the evidence from these is more clear cut. As they are reported more fully in Chapter 6 these tasks are only briefly described here.

Judgement task.

32 subjects attempted the task. On trials considered here they were presented with two cards on each of which was a geometric figure. The two figures might be the same in all of colour, shape and pattern or they might be different in all three. On eight trials the subject was asked whether the two were the same or not and on eight trials whether they were different or not. Only 20 subjects (5 in J1, 7 in J2 and 8 in J3) showed 100% performance in this apparently simple task and so a lesser criterion of at least 14 out of 16 correct responses was adopted as showing that the child understood the terms. The results are given in Table 3:14.

	J1	J2	J3	
At least 14/16 correct	9	9	9	27
8/8 for 'same' judgements, 0/8 for 'different' judgements	2	0	1	3
Other	2	0	0	2
	13	9	10	32

Table 3:14. Numbers of subjects showing different response patterns in judgement task.

The three subjects who score 100% for 'same' judgements but zero for 'different' judgements are treating the two sets of questions identically - that is, they respond as if 'different' meant 'same'. One of the two subjects in the 'other' category scored 8/8 for 'same' and 4/8 for 'different' and probably does not understand the latter term, and the other scored 5/8 for 'same' and 2/8 for 'different' and may have had some trouble in understanding the task in general.

Matching task.

This task was performed by the remaining 31 subjects. On each trial the subject was presented with a card showing six different birds and required to select another card either the 'same' as or 'different' from it from among eleven further cards. One of these was identical to the target, four had four bird pictures in common with it, four had two birds in common and two were entirely different. Thus only one card of the eleven can definitely be said to be an incorrect choice in response to 'different' trials and only two for 'same' trials. There were six trials given to each subject for each instruction. A child was considered to show a correct understanding of 'different' if he satisfied the following three criteria: he responded on all trials, he made no unambiguously wrong response on either 'same' or 'different' trials (the probability of satisfying this criterion by chance is .17) and the mean number of birds in common between target and selection was at least 1.0 higher for his 'same' choices than his 'different' choices. Application of these criteria yields the results shown in Table 3:15.

	J1	J2	J3	
Understand 'different'	6	8	10	24
Other	4	3	0	7
	10	11	10	31

Table 3:15. Numbers of subjects who show different response patterns in matching task.

Of the seven children who are not classified as correct in Table 3:15, one child in J1 fails because she did not respond on every trial, two subjects in J1 each chose an identical picture to the target in answer to one of the 'different' trials, and the remaining children have differences in the mean number of common birds of .67 in 3 cases and zero in one case.

Further evidence for understanding.

On the basis of these two tasks it seems that of the 63 subjects, 51 understood 'different', 3 quite clearly did not, and 9 cases are uncertain. Further evidence can however be obtained by examining the full protocols for both Claparède's task and the others used and in the case of the nine uncertain instances this is not too large a job to be attempted. This procedure throws no light on the two cases who were uncertainties following the judgement task, or on two subjects who performed the matching task, but it is useful in the remainder. One child who chose an identical card as 'different' in the selection task justified all her choices in terms of similarity (referring to the birds' tails in the one instance where there were no birds in common) and her behaviour in Claparède's task is very similar for both 'same' and 'different' problems. She seems then to be treating 'different' as if it meant 'same'. The child who did not always respond in the matching task and three of those whose selections were somewhat similar on 'same' and 'different' trials behave quite differently to the two types of problem in Claparède's task. Three of these justify their choices in the matching task appropriately and the justifications given by the fourth are uninformative. It seems reasonable to conclude that all of these understand 'different'. The final picture is as given in Table 3:4, reproduced here for completeness.

	J1	J2	J3	Total
Understand 'different'	16	20	19	55
Treat 'different' as 'same	3	0	1	4
Other	4	0	0	4
	23	20	20	63

Table 3:4. Numbers of subjects who do and do not understand 'different'

Section II. Matching for and judgement of similarity and difference and their justification.

Chapter 4. Selection of same and different objects and their justification.

In the experiments reported in the previous section children were required to give similarities, or differences, between objects selected for them by the experimenter. In the study to be reported in this chapter the children will themselves be asked to select an object which is either the same as or different from a target object, and to justify that choice. This may be easier than Claparède's task, as if the selection decision is made with awareness the basis of that decision should be available to be given in a justification. The universe of objects from which the selections are made is of course still determined by the experimenter, and its structure may be more or less congenial to the child's way of thinking of similarity and difference.

Reference has already been made in the previous chapter to a paper by Donaldson and Wales (1970) suggesting that young children do not distinguish between the terms 'same' and 'different', responding to both in a manner appropriate to 'same'. (Donaldson and Wales are careful not to say that their subjects think 'different' means 'same', although others have put just that interpretation on their results e.g. Clark (1973).) Their study is particularly relevant to the experiment to be reported in the present chapter and will be described in more detail here.

In Donaldson and Wales'task 15 children aged about 3 years 6 months were asked to select from a set of objects one which was either 'the same in some way' or 'different in some way' from a target selected from the whole set by the experimenter. The objects were either everyday objects such as eggcups and toothbrushes, or geometric forms, there being two sets of each. In one set of each the shape and colour of the objects coincided such that the subjects had to make their selection from two objects identical to the target and nine that were different in both shape and colour. In the other two sets shape and colour varied independently so that of the eleven objects available two would be the same in shape but different in colour to the target, three would be of the same colour but different shape and the remaining six different in both colour and shape. The finding was that the subjects showed a strong tendency to select an object as similar as possible to the target for all sets of stimulus material and both 'same' and 'different' instructions.

Donaldson and Wales point out that a common use of 'different' in both adult and child language is to refer to another object of the same kind as a known object, which is just what their subjects pick out. Glucksberg et al. (1976) take up this point, and suggest that the response of Donaldson and Wales' subjects was entirely appropriate. They replicated Donaldson and Wales' results, using slightly younger subjects and similar but not identical materials and instructions. They also asked their subjects to pick out beads that were either the same colour as or a different colour from a target bead, from a set of beads varying only in colour, and in this latter task their subjects were almost entirely successful. Glucksberg et al. claim that the 'different colour' instruction rules out the 'same type, different token' interpretation of 'different' and that their subjects' success shows that the difficulty lies not in understanding the term 'different' itself, but in understanding the entire construction in which it is used by Donaldson and

Wales, in the way they intend. They back this up by showing that a small majority of undergraduate subjects interpret the instruction 'Give me one that's different from this one' as requiring them to select another token of the same type, a finding which surprises the present writer.

Glucksberg et al.'s results suggest that the course of learning to understand 'different' may be more complex than is apparent from Donaldson and Wales' work. It is unfortunate that they switched materials when they changed to the 'different colour' instruction, as the possibility remains that the improvement in performance is due not to a simpler instruction but to the use of a stimulus set of simpler structure.

Both the Donaldson and Wales and the Glucksberg et al. studies were carried out with very young children, and it might be interesting to discover the later course of development of understanding of both terms. Karmiloff-Smith (1977) has shown that understanding of 'même' by French-speaking children is not adult-like until the school years in contexts where the same token is intended. Although such contexts are not employed in the present study, this is an indication that we cannot assume no further change in interpretation of 'same' after the age of three. As for 'different', when children stop picking items with all properties in common with a target, do they still go for objects with most properties common, or do they prefer objects as different as possible as offering the greatest contrast to 'same' objects? Are their first correct responses the same as later ones in this respect?

In the present study both school and pre-school age children are asked to select 'same' and 'different' cards from a number of cards of varying degrees of similarity to a target. A card identical to the target is sometimes, but not always, present. On some occasions the children are asked for cards that are the same or different with respect to some particular property, such as colour, and other qualified instructions using expressions such as 'a bit the same' are used. The children are asked to justify their choices.

The questions to be asked are these:

1. Do they distinguish between 'same' and 'different' instructions?
2. Does their interpretation of either or both of the terms change with age?
3. Do they respond to qualified instructions differently from neutral ones?

The extent to which their responses are influenced by the particular properties of the cards is also investigated.

Method.

Subjects.

102 subjects were tested, falling into five groups as follows:

	Number of subjects	Age range	Mean age
N1	19	2yrs 9mo - 4yrs 3mo	3yrs 9mo
N2	19	4yrs 4mo - 5yrs 4mo	4yrs 10mo
P1	27	4yrs 11mo - 5yrs 5mo	5yrs 3mo
P2	30	6yrs 6mo - 6yrs 11mo	6yrs 9mo
P3	7	7yrs 7mo - 7yrs 11mo	7yrs 9mo

The children in N1 and N2 were drawn from two playgroups, one organised in the psychology department and catering mainly for the children of the academic staff, and the other in the local community, where the children's background would not be very different from that of those in the former group. The division between N1 and N2 was made solely on the basis of age.

The children in P1, P2 and P3 came from a primary school in a deprived area. P1 and P2 represent the entire classes, but only a few children in P3 were tested because children of that age found the task boring.

These subjects were almost all also used in the experiment reported in chapter 2. Two subjects in N1 refused to take part in that experiment, and one subject in N1 for the previous experiment refused to participate in this one.

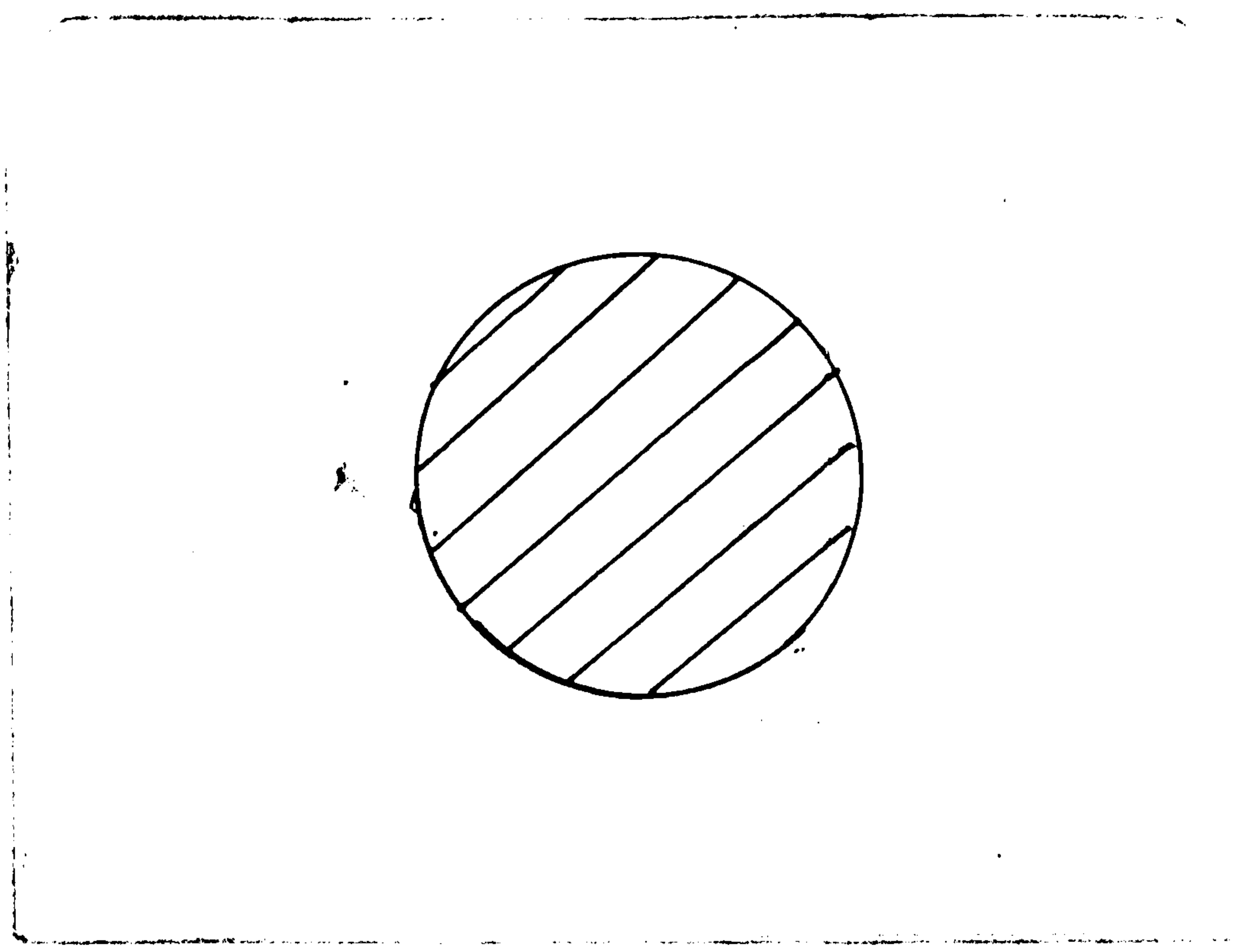


Figure 4:1. Example of stimulus card.

Materials.

The materials used were two sets of sixteen cards each. The cards were rectangular in shape and had geometric figures drawn on them, the sixteen cards representing the sixteen possible combinations of four properties, each of which can take two values as shown below.

Property	Values	
Colour	Red	Blue
	Both slightly dark but otherwise fairly prototypical	
Shape	Square	Circular
	3.4 cm side	3.6 cm diameter
Pattern	Striped	Spotted
	Thin, diagonal lines, approx 6 mm apart	Small spots, about 2 mm diameter
Number	One	Two

Figure 4:1 is a full size illustration of one of the cards.

Procedure.

The children were tested individually, sitting at a low table beside the experimenter in a small room close to their playroom or classroom. One set of sixteen cards was laid out unsystematically on the table. Half the children received all 'same' instructions before all 'different' ones, and the other half received them in the reverse order. For the first seven instructions of each kind the experimenter picked up one of the cards from the table to act as a target, while for the last instruction a card from the second set was used as target. Thus for seven 'same' and seven 'different' instructions the cards available consisted of four with three properties in common with the target, six with two properties in common, four with only one property in common and one card which had the opposite value to the target on each property. For the remaining two selections there was a card identical to the target available as well as these fifteen possibilities. The target cards picked from the table were picked haphazardly, save that the same card was never picked twice for one subject. The targets from the second set were just picked out from an envelope and might or might not be the same as another target used with that subject.

The selection instructions were as follows:

1. Can you find me something that's the same as this?
   Can you find me something that's different from this?
2. Can you find me something that's a bit the same as this?
   Can you find me something that's a bit different from this?
3. Can you find me something that's a lot the same as this?
   Can you find me something that's a lot different from this?
4. Can you find me something that's the same colour as this?
   Can you find me something that's a different colour from this?
5. Can you find something that's the same shape as this?
   Can you find something that's a different shape from this?
6. Can you find something that's the same pattern as this?
   Can you find something that's a different pattern from this?

7. Can you find something that's got the same number of things as this?

   Can you find something that's got a different number of things to this?

8. Can you find something that's the same as this?

   Can you find something that different from this?

Minor variations in phrasing were sometimes introduced to make the interaction seem more natural. The order of instructions from 1. to 8. was never varied. When a child had made his selection his chosen card was placed beside the target and he was asked 'How are they the same?' or 'How are they different?' At the end of the session the child was asked what colour, shape, pattern and number were some of the cards to check on his understanding of these terms. All sessions were tape-recorded for later transcription.

Results.

Not all the children made selections to every instruction. The ranges and mean numbers of selections in the different age groups were as follows:

	'Same'		'Different'		Overall		Children completing task	
	Range	Mean	Range	Mean	Range	Mean	Number	Percentage
N1	1-8	6.9	3-8	7.5	6-16	14.4	12	63
N2	0-8	7.4	7-8	7.9	8-16	15.3	14	74
P1	7-8	7.9	8	8.0	15-16	15.9	25	93
P2	7-8	7.9	7-8	8.0	15-16	15.9	27	90
P3	7-8	7.9	8	8.0	15-16	15.9	6	86
Total	0-8	7.6	3-8	7.9	6-16	15.5	84	82

Table 4:1. Number of selections made.

The number of children who make the full sixteen selections is also shown, and makes up 82% of the total subject sample. A Kruskal-Wallis analysis of variance results in a significant difference between the groups in number of selections made ($H = 10.64$, $df = 4, p < .05$). This is obviously due to a difference between the 2 nursery groups and the school group as a whole.

Some children did not make the full number of selections because they gave up before completing the task, others simply refused to respond to one or more instructions in the course of the session. The figures suggest that 'same number' and 'different number' instructions were particularly vulnerable to such refusals and neutral instructions least likely to lead to them, as shown in Table 4:2.*

	Total	Neutral (15)	Bit	Lot	Colour	Shape	Pattern	Number	Neutral (16)
Same	37	1	4	5	5	5	4	11	2
Different	12	1	2	1	1	1	2	3	1
Total	49	2	6	6	6	6	6	14	3

(15) (16): No. of cards available with neutral instructions

Table 4:2. Number of selections not made, by instruction.

*There are more missing selections for 'same' instructions than for 'different' ones.

Selections.

Figure 4:2 shows the mean number of properties in common between the target and the children's selections for the different age groups and instructions, for the 84 children who completed the task. The points in Figure 4:2A for selections from 15 cards (instructions 1-7) are based on results averaged over all seven selections per subject.

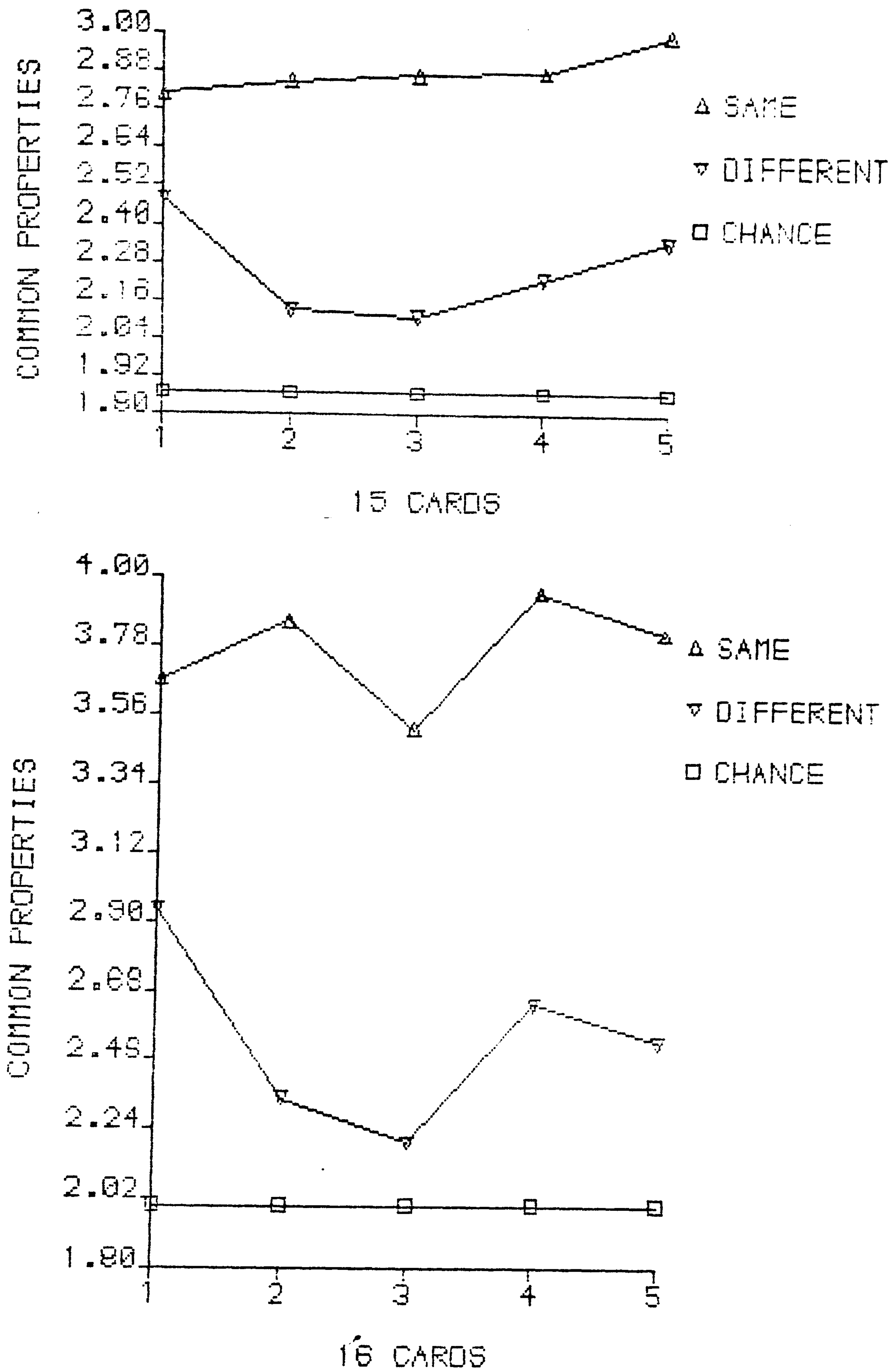
Age effects in similarity of selections.

As in previous chapters there is a problem in testing for age effects in that the group of subjects who complete the task is more highly selected from the younger age groups than the older ones, whereas if the whole sample is taken into consideration different subjects take different problems and the results are not strictly comparable. The results of both forms of analysis on the number of properties common between the selections and target are given in Table 4:3.

		Same		Different	
		H	p	H	p
84 Ss, instructions	1-7	7.21	ns	7.06	ns
All available Ss,	1-7	5.14	ns(101Ss)	11.36	$p < .05$(102Ss)
84 Ss, instruction	8	10.41	$p < .05$	5.17	ns
All available Ss,	8	11.94	$p < .05$(100Ss)	7.39	ns(101Ss)

Table 4:3. Kruskal-Wallis analyses of variance for differences between groups in mean no. of common properties (instructions 1-7) and no. of common properties (instruction 8). Df = 4 in all cases.

Figure 4:2 suggests that the difference between the groups in response to instruction 8 is greater for 'different' than for 'same' selections but the variance within the groups is also greater, which explains the pattern of results shown in Table 4:3.



<u>Key</u> 1:N1 2:N2 3:P1 4:P2 5:P3

<u>Figure 4:2. Mean number of properties common to target and selections for subsample of 84 subjects.</u>

There is a clearly incorrect card - one with no properties in common with the target - available for all 'same' selections but such a card was chosen only once, by a child in N1. An identical card was available for one 'different' selection for each child and was chosen by seventeen of the 101 children who made a selection in this situation. These seventeen subjects consist of seven from N1, one from N2, four from P1 and five from P2 and their total number is well above what would be expected if selections were made at random.

Similarity of selections and distinction between 'same' and 'different'.

Figure 4:2 suggests that selections are more similar to the target than would be expected by chance, in response to both 'same' and 'different' instructions. It is possible to compute for individual children the probability of obtaining selections as extreme as theirs by chance. For all 84 children who complete the task the probability of selections as similar as the ones they make in response to 'same' instructions occuring by chance is less than .05. Only seven of this group, consisting of one child in N1, two in N2, three in P1 and one in P2, make selections in response to 'different' instructions that are significantly more dissimilar than chance at the .05 level.

Although the children always make rather similar selections, as a group they are clearly distinguishing between 'same' and 'different' instructions as Figure 4:2 suggests. 83 subjects make 'same' selections in response to instructions 1-7 which have a mean number of properties in common with the target higher than for their 'different' selections while only 8 subjects do the reverse. For responses to instruction 8 the figures are 76 and 7 children respectively.

For individual children, sign tests can be carried out on their selections to determine whether they are responding differently to 'same' and 'different' instructions at a statistically significant level. The numbers out of the group of 84 who do chose significantly more similar cards in response to 'same' instructions, using a criterion of $p < .05$ and 1-tailed tests are given in Table 4:4.

	N1	N2	P1	P2	P3	Total
Number of subjects	2	8	12	14	3	39
% of age group	17	57	48	52	50	46

Table 4:4. Children who distinguish between 'same' and 'different' in the similarity of their selections.

The difference in numbers between the age groups is not statistically significant. ($\chi^2 = 5.29$, df = 4, ns.)

Responses to qualified instructions.

It must now be examined whether the children respond to the more subtle differences in instructions. All but six of the subjects (96 in all) respond to all four of the 'a lot the same', 'a bit the same' and corresponding 'different' instructions. Only 19 of these make selections with different numbers of properties common to the target to the two 'same' instructions and these are evenly divided as to which instruction leads to the more similar choice. 26 children make a more dissimilar choice to 'lot different' than to 'bit different' compared to only 16 for the reverse, but this difference is not statistically significant either.

Responses to instructions qualified with respect to property are more difficult to assess as many children apparently did not put the intended interpretations on the terms 'colour', 'shape', 'pattern' and 'number'. Only 27 children (1 in N1, 3 in N2, 5 in P1, 15 in P2 and 3 in P3) responded appropriately to all the questions such as 'What colour is this?' and made all the relevant selections. Several of the pre-school children were restless by the end of the session and refused to answer the questions - it seems unlikely that they did not know the meaning of 'colour'! 'Pattern' was sometimes interpreted as 'shape' and unfortunately 'number' was often quite reasonably thought to refer to small pencilled numerals put on the cards for the experimenter's benefit.

The pattern of results given by the group of 27 children referred to is similar to those for the larger groups who show understanding of a particular term, though they make rather fewer errors. The group of 27 alone will be considered in what follows, as it is only for them that comparisons between the terms can properly be made.

Although the members of this group appear to understand the terms they still make errors such as selecting a card of a different colour when one the same colour is asked for, as shown in Table 4:5. The numbers of errors are partly determined by the children's underlying strategies - for instance, because they tend to choose cards of the same shape as the target regardless of instruction, they make more errors in responding to the 'different' shape instruction than to the 'same shape' one. There are however differences in the frequency of errors with colour and shape giving rise to the fewest and number to the most.

	Colour		Shape		Pattern		Number	
	No.	%	No.	%	No.	%	No.	%
Same	1	4	0	0	4	15	8	30
Different	3	11	5	19	5	19	6	22

Table 4:5. Numbers and percentages of children responding incorrectly to instructions qualified with respect to property.

Whether in spite of the errors the children are significantly responding to the instructions can be examined by carrying out binomial tests on the number who change in the appropriate direction between the first instruction and the one under scrutiny (e.g. choose a card of a different colour for the neutral instruction but one of the same colour when that is requested) versus the number who change in the opposite direction. These tests do not take into account the size of the pool of subjects in a position to change in the right direction, e.g. those who chose a different colour in response to the first instruction in the above example, and are sometimes not applicable because this pool is too small for a significant result to be possible. The size of this pool is given in all cases in Table 4:6.

	Colour		Shape		Pattern		Number	
	No. change	p	No. change	p	No. change	p	No. change	p
Same	15/16	< .001	0/0	n.a.	1/2	n.a.	5/9	n.s.
Different	15/17	<.001	17/22	< .001	9/14	< .01	13/16	<.05

No. change: No. of subjects changing response between neutral and specific instructions in the right direction / no. of subjects in a position to do so.

n.a.: not applicable.

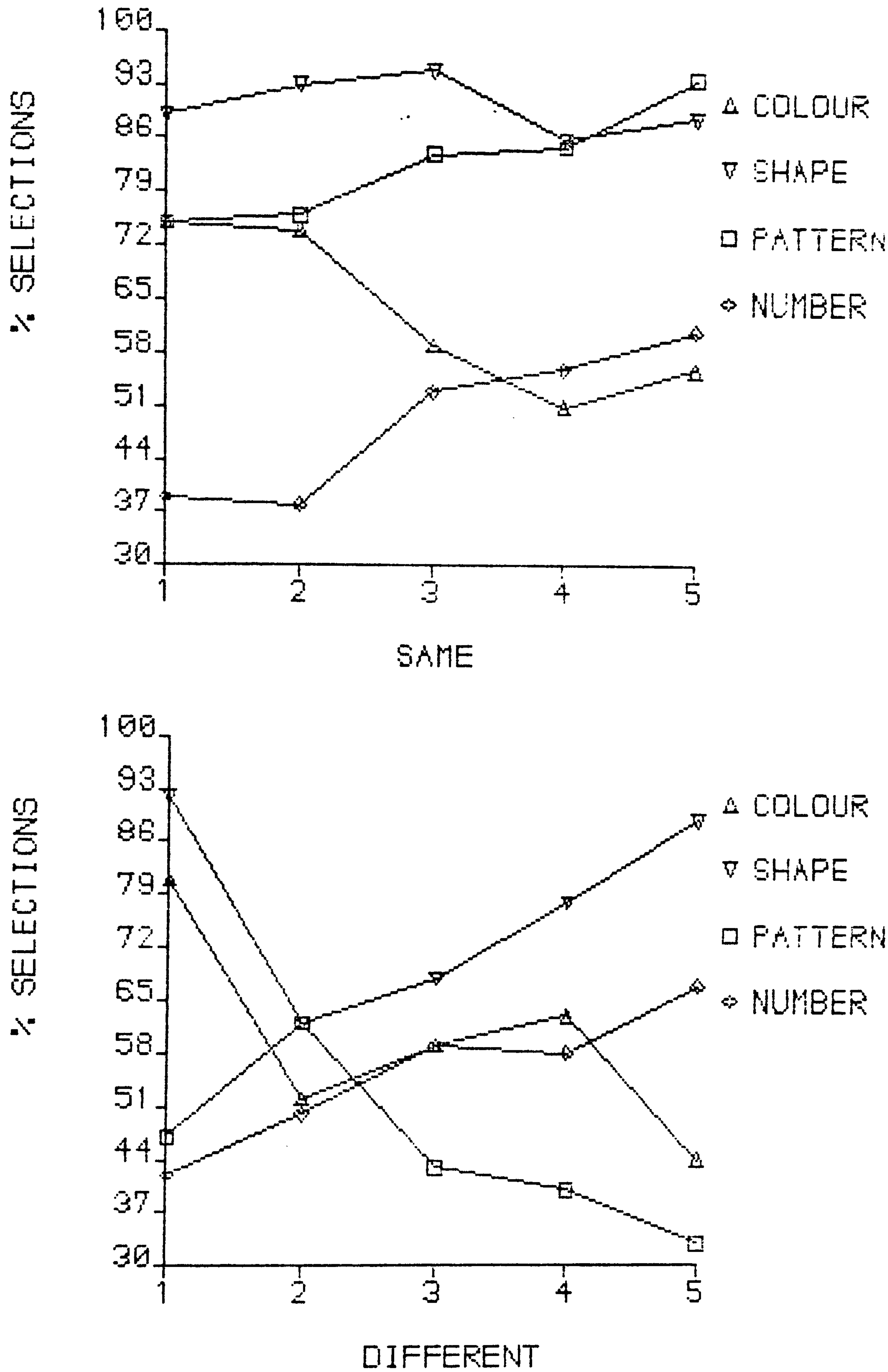
Table 4:6. Results of binomial tests on responses to instructions qualified with respect to property.

If Glucksberg et al. (1976) are correct one might expect 'different' instructions specified with respect to some property to lead to more dissimilar selections than neutral instructions, at least for the youngest subjects. Inspection of the results shows no difference for

N1 taken alone, mainly because there are very few subjects who show that they understand a particular term, respond appropriately to its specified instruction and choose cards with different numbers of properties in common with the target for different instructions. The subjects as a whole do make more dissimilar choices to specified instructions than to neutral ones but this is just as true for 'same' instructions as for 'different' ones, which Glucksberg et al. would not predict.

Weighting given to different properties in selection.

Figure 4:3 shows the percentages of selections made by the subjects which have a particular property in common with the target. 'Same' selections tend to be the same shape as the target for all age groups and, increasingly with age, of the same pattern also. Colour shows a considerable drop and number a considerable increase between the pre-school and school groups, both these properties tending to be less important than the former ones. For 'different' selections N1 is quite different from the other groups. For these others, selections of the same shape as the target show a strong tendency to increase with age and those of the same pattern to decrease. The children distinguish between their 'same' and 'different' selections in terms of pattern more than any other property.



Key 1:N1 2:N2 3:P1 4:P2 5:P3

Figure 4:3. Percentages of selections to neutral instructions having particular properties in common with the target for sub-

Justifications.

The children's justifications for their selections were divided into four categories, similarities, differences, both, and no responses. 'No responses' include 'don't know' and simple assertions that two cards are the same or different, as well as literal no responses. 'Similarities', 'differences', and 'both' are more or less self-explanatory, but it must noted that they include, as well as justifications citing the properties intended by the experimenter to be considered, a small number citing other properties, such as the pencilled numerals already referred to, or slight dirty marks on the cards.

Unfortunately, part of the sessions for two subjects failed to be recorded and consequently although there is full information on their selections the record of their justifications is incomplete. One of these children was among the group of 84 who completed the task and so this group is reduced to 83 as far as justifications are concerned. All that follows is based on this group of 83 except where otherwise stated. Figure 4:4 shows the proportions of the different kinds of justifications offered by these 83 subjects.

'Same' and 'different' justifications.

At first sight Figure 4:4 suggests that other than for N1, performance is about the same for justifications of 'same' and 'different' selections - about 70 - 90% correct in both cases. However, figure 4:4 does not take into account the fact that selections are always inclined to be similar to the target rather than otherwise. If a child simply justifies his choice by citing some random property without regard for whether that property constitutes a similarity or

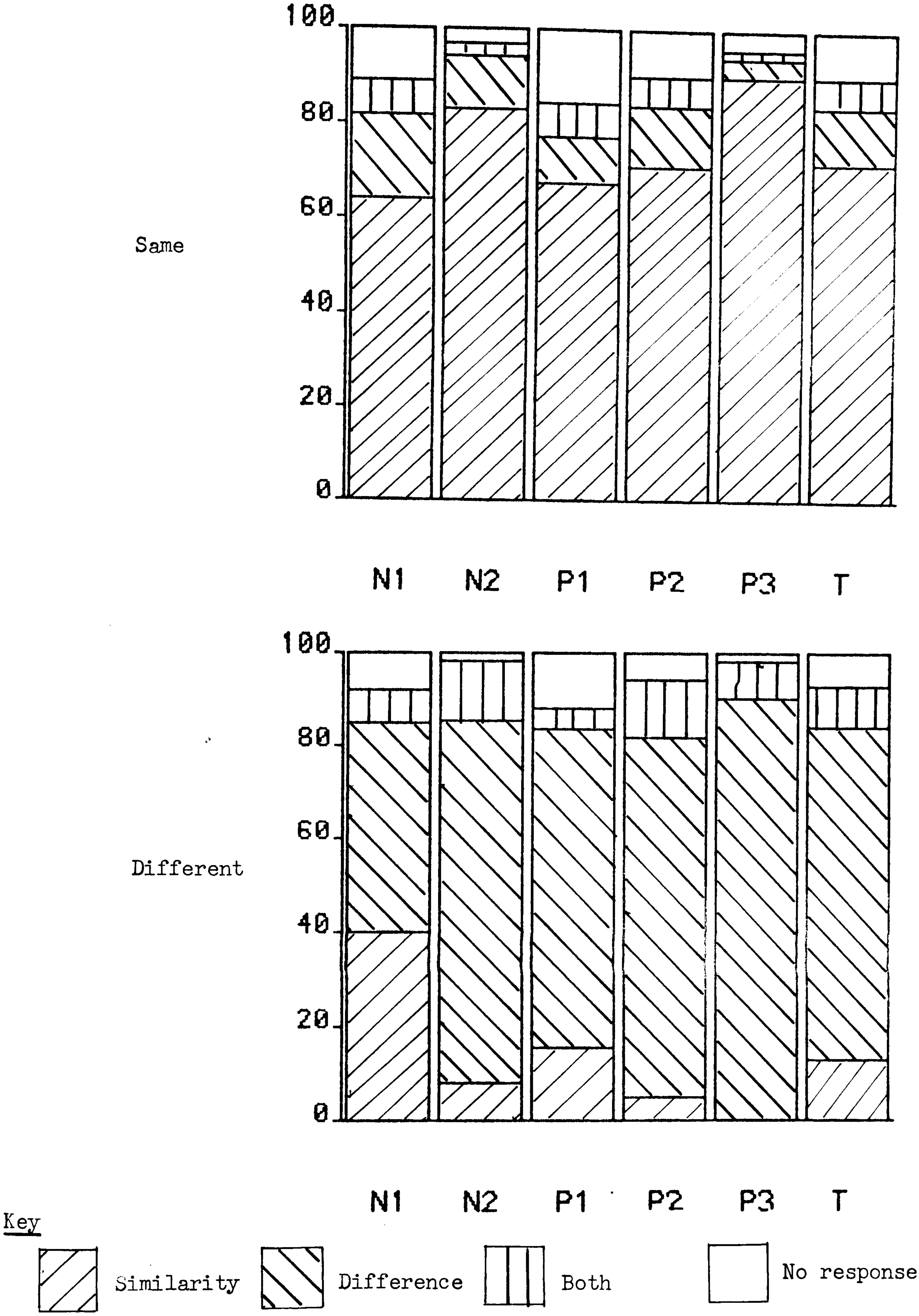


Figure 4:4. Percentages of justifications of different types, for sub-sample of 83 subjects.

a difference, he is more likely to give a similarity both for same and different choices. It is possible to calculate the probability of a child with a particular response strategy giving as many similarities for 'same' justifications, or differences for 'different' justifications as they happen to, by chance. This is perhaps best illustrated by an example.

N2: Phillipa, aged 5:3.

Same selections: Phillipa's justification for her selection to the 8th instruction is a 'no response' and is disregarded. The number of her selections of different degrees of similarity to the target, the number of properties she cites in justification and the associated probability of that justification being a similarity, are as follows:

	No. of props. common with target
No. of props. cited in justification	3
1	4 (.75)
2	3 (.50)

All seven justifications are similarities; the probability of this occurring by chance is $.75^4 \times .5^3$, or .04

Different selections:	No. of props. common with target		
No. of props. cited in justification	1	2	3
1	0	3 (.50)	4 (.25)
2	1 (.50)	0	0

The probabilities are this time the probabilities of giving a difference. Phillipa gives seven differences.

P (eight differences) = $.25^4 \times .5^4 = 0.00024$

P (seven differences) = $4(.25^3 x .5^4 x .75) + 4(.25^4 x .5^4) = 0.00391$.

So the probability of a performance at least as extreme as Phillipa's is 0.0042.

This example illustrates the fact that, given the selections the children make, they may be giving significantly more differences than would be expected by chance with fewer correct responses than would be required for similarities. An awkward case is that of subjects who always make 'same' selections that are as similar as possible to the target and justify them with respect to one property only: these have a chance probability of finding eight similarities of $1.00 \times .75^7$ or 0.13 - that is, even perfect performance would not normally be considered significantly better than chance. Adopting two criteria, a stringent one of $\leq .05$ probability of obtaining such a score by chance, and a more lax one of $\leq .1$ or perfect performance, the numbers of subjects who satisfy the criteria are given in Table 4:7.

No. of subjects out of 83	Same			Different		
	$\leq .05$ by chance	$\leq .1$ or perfect	other	$\leq .05$ by chance	$\leq .1$ by chance	other
N1	0	3	8	4	1	6
N2	6	2	6	10	1	3
P1	2	9	14	14	2	9
P2	6	6	15	20	0	7
P3	0	3	3	5	1	0
	14	23	46	53	5	25

Table 4:7. Likelihood of 'same' and 'different' justification patterns

Perfect performance on differences always satisfies the .05 criterion. Phillipa is of course among those in N2 who satisfy this criterion in both cases. Cases where properties other than those of colour, shape, pattern and number are offered in justification have to be counted as 'no responses' for present purposes. χ^2 tests can be carried out on the above figures, collapsing the three categories into two of most nearly equal size and combining P2 and P3 so as to increase expected values. These show no statistically significant differences between the groups (same: χ^2 = 2.24, df = 3, n.s., different: χ^2 = 6.63, df = 3, n.s.)

Cases where 'different' is treated as 'same'.

Which, if any, of the 25 subjects who fail even the lax criterion for appropriate 'different' justifications can be considered to treat the term as if it meant 'same'? Eight of these distinguish between 'same' and 'different' in terms of their selections and can be excluded, as can a further four children who give too many 'both' justifications to be considered as knowing 'different' but never justify a 'different' selection with a similarity. Of the remaining 13 children, five seem to be good candidates. Two seem to be clear cases: one turns in identical performances for 'same' and 'different', always choosing one of the most similar cards available and justifying it with a similarity; the other makes slightly more similar selections for 'different' than for 'same' and after not responding for her first seven justifications gives similarities to justify her final 'same' selection and all her 'different' selections. The other three children each justify one 'different' selection with a difference but give six or seven similarities in that condition and their performance in the two conditions is so similar for both selection and justification that it seems reasonable to include them here. The final eight subjects behave in a variable or uninformative manner.

The five subjects who appear to treat 'different' as if it meant 'same' consist of three from N1, one from N2 and one from P1. It seems likely from an inspection of the results that some of the 19 subjects not in the group of 83 here considered make the same error but as there is less information available for these children it would be more difficult to arrive at a decision concerning them.

Responses to instructions qualified with respect to property.

To what extent is a property, say colour, more than usually likely to be mentioned when justifying a selection which is the same or different with respect to that property? Table 4:8 shows, for the group of 27 subjects who understand all four property terms, the number of those who are in a position to change their justification in the appropriate direction who actually do so, and the results of binomial tests comparing those who change in one direction with those who change in the opposite direction.

There is no tendency for 'different' instructions specified with respect to property to result in more differences given in justification than neutral instructions.

	Colour		Shape		Pattern		Number	
	No. change	p	No. change	p	No. change	p	No. change	p
Same	9/23	n.s.	9/18	$< .05$	8/12	n.s.	3/24	n.s.
Different	17/23	$< .001$	15/19	$< .001$	11/16	$< .01$	9/22	$< .05$

No. change: No. of subjects who mention the appropriate property in justifying the specified selection but not the neutral one, out of those who do not mention it in the latter case.

Table 4:8. Results of binomial tests on responses to instructions qualified with respect to property.

Weighting given to different properties in justification.

Assessment of the children's overall tendency to cite particular properties in their justifications is difficult, as the situations in which they offer justifications vary as a result of their different selection strategies. Overall, if one looks at selections in response to instructions 1-3 (i.e. neutral with respect to property, and fifteen cards available for selection), pattern is mentioned in 54% of justifications, shape in 29%, colour in 13% and number in 11%. The percentages sum to more than 100 as more than one property is sometimes mentioned in the same justification. These figures take no account of opportunity. Table 4:9 gives the number of times a property is mentioned correctly as a percentage of the number of times the opportunity is available. For instance, pattern is mentioned in 59% of justifications of 'same' selections of the same pattern as the target.

	Colour	Shape	Pattern	Number
Same	13	29	59	8
Different	30	77	77	27

Table 4:9. Percentages of appropriate mentions of properties.

The children vary in the extent to which one property predominates in their justifications: some children cite a particular property in every one of their answers while for others no single property is mentioned in as many as half of their answers. Those who do cite one particular property all or most of the time also vary in the extent to which this strategy leads them into error. Table 4:10 shows the number of children who cite one particular property in at least four of their justifications of the six 'neutral' selections, and of these, the number who never wrongly cite that property (i.e.

never give it as a similarity when a difference is asked for or vice versa).

	Ni: No. citing a property on $\geqslant$ 4/6 occasions	% of group	Nii: No. always citing that property correctly	$\frac{Nii}{Ni}$ %
N1	7	64	1	14
N2	12	86	5	42
P1	17	77	9	53
P2	19	70	11	58
P3	5	83	5	100
	60	75	31	52

Table 4:10. Subjects who concentrate on one property in justification.

The extent to which the children rely on some particular property for their justifications does not vary much with age group but the extent to which this strategy leads them into error shows a trend with age. A χ^2 test for the numbers who never make an error, combining N1 and N2, and P2 and P3, because of the small numbers, fails to reach the usually accepted level of significance (χ^2 = 5.25 df = 2, $<$.1), but because this does not take into account the consistent trend we might be justified in accepting that there is a real difference. It seems that the older children have their selections and their justifications better coordinated than the younger ones do.

Simple assertions of similarity and difference

Finally, a comment about 'no responses' in justification. It was mentioned that these include simple assertions that the two cards are the same or different without explaining where the similarity or difference lay. Two subjects make such assertions for both similarity and difference, ten for similarity only and one for difference only. Such responses account for 34% and 22% of 'no responses' justifying 'same' and 'different' selections respectively.

Discussion.

The present experiment confirms the results reported by Donaldson and Wales (1970) in so far as the children do tend to pick cards rather similar to the target in response to instructions both to select one 'the same' and to select one 'different', and they pick an identical card when asked for a different one more often than would be expected by chance, while there is only one case of a card with no properties in common with the target being selected in response to 'same' instructions. (The procedure does of course require the children to accept the experimenter's definition of the situation - that the only similarities and differences that are to count are those of being red or blue, square or circular, spotted or striped, and single or double. As one subject in particular was inclined to point out, 'identical' cards may differ in for example the precise arrangement of spots, and of course any two cards share a great number of properties, though the only similarities offered which were not in the experimenter's terms involved reference to what was drawn on the cards, not to the cards themselves.)

The first question asked in the introduction was whether or not the children distinguished between 'same' and 'different' instructions. As a group they evidently did, most making more similar 'same' selections than 'different' selections and most of their justifications also being appropriate. Only five subjects, three of them in the youngest age group, seemed clearly to be treating 'different' as if it meant 'same' though others for whom there was less information available were probably doing so also. As individuals the children in N1 were less likely to distinguish between their 'same' and 'different' selections in a statistically significant manner than were the older children.

The tendency to respond in the same way to 'same' and 'different' is then less marked in this study than in that carried out by Donaldson and Wales. It should be noted that even the children in N1 were on average slightly older than Donaldson and Wales' subjects.

The next question asked was whether interpretation of the terms changed with age, over and above the acquisition of the correct interpretation of 'different'. The age groups only differ significantly in their 'same' selections when the identical card is present, the tendency to pick that card increasing with age from N1 to N2 and from P1 to P2 but dropping to P3 (which is of course a very small group). Interpreting change from N2 to P1 is difficult because the subjects come from different populations. It is unlikely that the difference represents a change in interpretation of 'same' with age: indeed Karmiloff-Smith (1977) suggests that for French-speaking children at least, acceptance of objects which have some but not all properties in common as 'the same' increases with age. The fact that selections in response to instructions 1-7 also tend, though non-significantly, to increase in similarity with age suggests just an increase in precision in performing the task, and in the case of the identical card, an increasing recognition that on this trial, unlike former ones, there is an identical card available.

A change in 'different' choices on the other hand is only apparent when all subjects and instructions 1-7 are considered. The pattern is very similar to that graphed in Figure 4:2 for the sub-group of 84 subjects, for whom the differences were not significant. The youngest and the oldest subjects make the most similar selections, probably for different reasons: the young subjects' choices are similar to the target because some of them treat 'different' as if it meant 'same', while the older ones make rather similar choices because they realise that a card does not have to be very dissimilar to count as 'different'. Only a few subjects made significantly dissimilar 'different' choices and these were particularly rare in P2 and P3. Taken in conjunction with the U-shaped curve for 'different' selections just referred to, we do have some slight evidence for the notion that when children first understand 'different' they prefer a greater degree of dissimilarity than later. It may be a rather sophisticated notion that in a set of objects in which none are identical to the target, any object which is 'the same' as the target is also 'different' from it. (Of course a child who picks a card with three properties in common with the target as 'different' may not be aware at that moment that such a card is his preferred exemplar of a 'same' card.)

Most of the children appear to feel that the best exemplar of something 'different' is something only a little dissimilar. This ties in with the point made about the ordinary language use of 'different' in the introduction, but does not go so far as Glucksberg et al.'s (1976) interpretation of 'different' as 'another token of the same type'. The question of the children's response to instructions qualified with respect to property is relevant here. Glucksberg et al.'s claim that expressions such as 'different colour' are less ambiguous and likely to be interpreted as requiring a different type when 'different' on its own is not so interpreted does not seem to be borne out in the present study. There is a tendency to choose more dissimilar cards in response to instructions to choose a card different with respect to some property than to neutral instructions but it is not more marked than for the corresponding 'same' instructions. The reason for this change is not clear. Nor is there support for Glucksberg et al.'s interpretations from the children's justifications, though these are in any case rather remote from the original instructions. Of course the present study differs from Glucksberg et al.'s in a number of ways, not least in that the subjects are in general older and tend to distinguish 'same' and 'different' anyway, while there are too few responses from subjects in N1 for the position with them to be clear. The fact that in this study the specific property instructions were applied to the same set of materials as the other instructions may make a difference and so too might their being embedded in the other instructions and not, as in Glucksberg et al.'s experiment, delivered afterwards with the change of materials also signalling a different task to the children.

In general the children in the present experiment are not very good at responding to instructions that are further specified than simply asking for a 'same' or 'different' card. They do not distinguish at all between 'a lot the same' and 'a bit the same' or 'a lot different' and 'a bit different'. They do show some tendency, both in selection and justification, to respond to instructions specified with respect to some property, but there are a considerable number of selection errors. Some of these may be due to a child who correctly interprets a term at the end of the testing session not interpreting it in the same way at the time of the instruction but it is unreasonable to suppose that this is a complete explanation.

Donaldson and Wales did at least some of the time ask their subjects to justify their choices but they do not report on the results. Here it seems that although choices are better for 'same' than for 'different', as indicated by the number of clearly incorrect selections, justifications are as good for 'different' as for 'same', in terms of the absolute number of appropriate ones, and very much better if the greater chance likelihood of an appropriate 'same' justification is taken into account. That the children are better at 'different' justifications than 'same' ones is very much in line with the findings of Chapters 2 and 3. Their performance on 'same' justifications is not as bad as the performance in giving similarities of the subjects employed in those experiments but this could be either because of the nature of the objects to be compared or because, as suggested in the introduction, in the present study the children are justifying their own choices, not those of the experimenter. Claparède (1918) argued that in line with his law of awareness similarities are difficult to give precisely because children make more early automatic use of similarity than of difference. The greater ease of 'same' choices found here may reflect this.

The different properties involved in the stimulus array are clearly not equivalent in their influence on the children's selections and justifications. All choices, both 'same' and 'different', tend to be of the same shape as the target (94% 'same' and 77% 'different') while 'same' choices tend to be the same pattern (83%) and 'different' choices a different pattern (56%) than the target. Number is odd in that 'different' choices are slightly more likely to be of the same number than 'same' ones. Colour declines in importance with age while number and pattern increase in importance. Given that pattern shows the most change between 'same' and 'different' it is not surprising that it is the property most cited in justification - it may well be the property the children are most aware of in making their selections - but this does not explain why shape should commonly be mentioned when justifying a 'different' selection. Apart from the dominance of pattern, the children seem to give most weight in justification to those properties to which they give most weight in selection. These remarks are not intended to be generalised to other situations involving the properties colour, shape, pattern and number; they may only apply to the values and combinations used in the stimulus array under discussion.

Many of the children adopted a particular property, most usually pattern, and cited it in most or all of their justifications, and this tended to lead the younger ones into error as they often cited it inappropriately. The fact that some children do behave in this way lends weight to the practice used in this chapter of testing the children's justification performance against a null hypothesis of their settling on some property at random and citing it whether it be a similarity or a difference.

The overall picture we have from this experiment is one of children who find it very easy to make similar choices and more difficult to make different choices but who find the latter easier to justify, suggesting greater awareness of the differences between the cards than of the similarities. It is relevant here that the children were more likely to move to mentioning the appropriate property in justifying a property-specified 'different' selection than for such a 'same' selection. This difference could arise if the symbols were perceived as wholes in making 'same' selections and could not easily be analysed so as to make available an isolated property to be cited in justification. This is supported by the more frequent occurrence of simple assertions that two cards are the same than of assertions that they are different. Even if the symbols were analysed into properties for justification purposes this process would be disconnected from the selection process. If on the other hand different choices were made on the basis of properties of the symbol arrived at by analysis they might well be more difficult but once made the property or properties used as the basis for selection should be available for use in justification.

Some support for the notion that children do sometimes perceive things holistically and sometimes analytically comes from recent work on perceptual development by Smith and Kemler (1977). In work on adult perception use is made of a distinction between integral and separable dimensions (e.g. Garner 1970). Integral dimensions are those which cannot be separately perceived in a stimulus, such as brightness and saturation, while separable dimensions such as shape and colour can, as the name suggests, be separately perceived. If asked to classify objects varying along integral dimensions adults sort on the basis of overall similarity while they sort objects varying along separable dimensions according to their values on those dimensions. Smith and Kemler showed that dimensions which are separable for adults can be integral for young children. One of the situations they used will be described here.

Smith and Kemler formed tetrads of cards showing a constant irregular shape but varying in size and brightness as shown in Figure 4:5. The tetrad can be divided into pairs in two ways: a dimensional classification, such that the members of each pair share a value on one dimension, and a similarity classification, which maximises the overall similarity between the members of a pair although they do not share the same value on either dimension. When 5, 8 and 10 year old children were asked to divide the tetrads into pairs the five year olds preferred the similarity classification, the 10 year olds preferred the dimensional classification and the eight year olds did not significantly favour either type. What is particularly interesting is that having made their first division as stated the children were asked if they could divide the tetrad another way, and many of those who initially opted for the similarity classification managed to produce the dimensional one. Smith and Kemler conclude that the primary mode of perception of

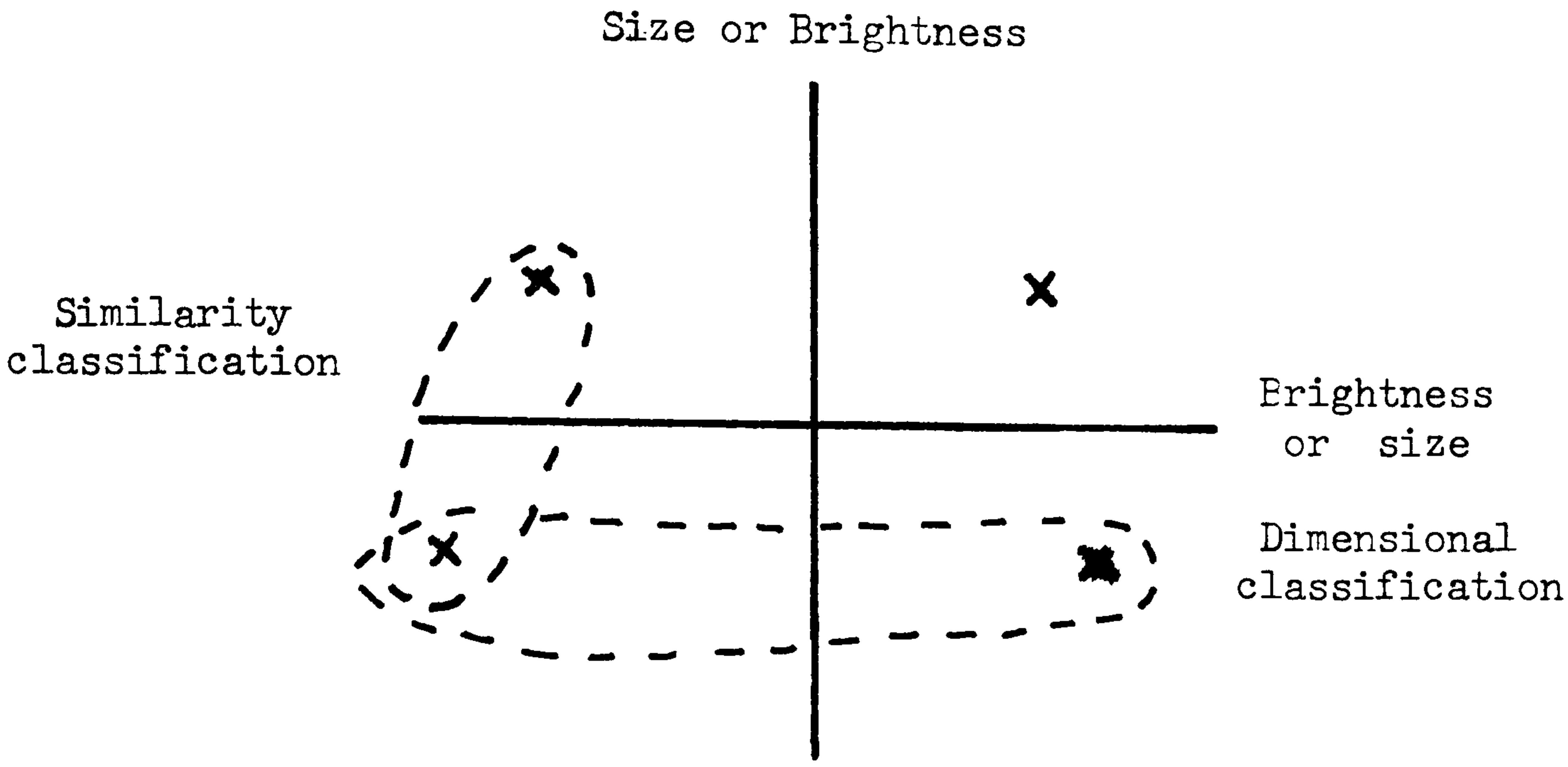


Figure 4:5. Dimensional and similarity classifications of stimuli varying along 2 dimensions. (From Smith and Kemler 1977)

these dimensions for the youngest children is integral but that they can analyse the dimensions at what they call a more derived or higher level mode of processing. Shepp (1978) also showed that for many six year olds hue and shape or brightness and shape are integral dimensions.

Number is unlikely to be integral with the other dimensions used in the present study, but it may be that some of the younger subjects tend to perceive colour, shape and pattern integrally as their primary mode. Being asked for a difference may sometimes switch them into a separable mode but they may not be able to do this at will. This would explain some of the results. The younger children who concentrate on one property in justification often cite it in error, suggesting that it may not have been the basis of their selection, while the older children seem to have their selections and their justifications better coordinated with each other. The younger children may stick to a single property because it is the only one they can perceive separately.

It may be that individuals are aware of separable dimensions in a way they are not of integral dimensions - that the awareness can as it were get hold of dimensions in a way it cannot of vague overall similarity or difference. This is in line with Wohlwill's (1968b) characterisation of perception and conception as differing along three dimensions, two of which he describes as follows:

(i) Redundancy. As one proceeds from perception to conception, the amount of redundant information required decreases.

(ii) Selectivity. As one proceeds from perception to conception, the amount of irrelevant information that can be tolerated without affecting the response increases.

In both these cases one could substitute integral perception for perception and separable perception for conception. Wohlwill's third dimension is contiguity:

(iii) As one proceeds from perception to conception, the spatial and temporal separation over which the total information contained in the stimulus can be integrated increases.

Presumably one cannot have integral dimensions that are very much separated either spatially or temporally. Both Smith and Kemler (1977), and Shepp (1978) acknowledge their debt to Wohlwill.

The children's performance in giving 'different' justifications is of course far from perfect and some of the errors may be due to the difficulty of perceiving the dimensions separately.

This account is also helpful in throwing light on the results of the earlier chapters. Rosch (e.g. Rosch 1977) has emphasised that natural categories are defined by overall similarity relations and not in dimensional terms, as Smith and Kemler acknowledge. This is likely to make the members of natural categories even more difficult to analyse into component properties which could be offered as similarities between them, as is borne out by the results reported in the previous section.

Chapter 5. Judgements of 'same' and 'different' and the strategies children use to gain information.

Introduction.

The task set to subjects in the experiment to be described in this chapter is somewhat different from those used in earlier chapters. Previously, children have been asked to say what is the same, or what is different, about two objects. In the present experiment they will simply be asked to say whether or not two objects are the same, or are different, as the case may be.

The design of the experiment is based on one carried out by Vurpillot (1968) which will now be described. Vurpillot presented subjects aged 2 to 9 years with pairs of cards, each card showing a house with six windows. The windows on any one house were all different and a pair of houses might have 1, 3, 5 or 6 pairs of identical windows. The subjects' task was to say whether the pairs of houses were the same (that is, were the same in all six windows) or not the same; the word 'different' was not used. Vurpillot recorded the children's eye movements in looking at the cards and so obtained measures of how much information the children collected before making their judgements, and how efficiently they collected this information. She found that not all children were basing their judgements on her definition of 'same' as having all six windows the same. A considerable number of children, especially in the younger age groups, judged two houses to be the same if any pair of identical windows was found. Also, a number of children, including about half the pre-schoolers, showed no systematic interpretation by their judgements. There was a tendency for the children to base their judgements on too little information - that is, they did not look at a sufficient number of windows. Because of this, they made most errors on the pair of cards with only one difference (as this difference was likely to be missed) then on the pair with three similarities and three differences, then on the pair with five differences, with the identical pairs being easiest of all. The most efficient way to gather the necessary information is to look at one window, then at the corresponding window on the other house and so on until enough evidence for a judgement has been collected. The older children were more likely to collect the appropriate amount of information and also gathered it more efficiently than the younger ones.

The present study differs in a number of ways from that carried out by Vurpillot. Firstly, subjects were asked to judge whether pairs of cards were different or not, as well as to judge whether some pairs were the same or not. Any subject who responds to 'different' in the same way as to 'same' (Donaldson and Wales 1970) would obviously make fewer correct 'different' judgements. The number of such subjects would never be expected to be very great, and would be expected to decline with age.

As mentioned, Vurpillot determined which windows the children looked at by means of eye movement recordings. This has some disadvantages, over and above that of requiring sophisticated equipment. Vurpillot's subjects did not have their heads clamped but they were sometimes restrained by the experimenter and at all times they were instructed to keep their heads still and only move their eyes. The situation must have been somewhat unnatural and perhaps a little intimidating. In the present study the cards were put into folders with six windows, one over each picture on the card, and the children had to open the windows to see the pictures and arrive at their decision. They were instructed to announce their decision as soon as it was reached. This procedure may also modify the children's performance, either improving it by forcing them to think more about what they are doing or depressing it by preventing them from gaining incidental information in a casual glance. So, as a control, the cards were also just put before the children without their folders and they were asked to make their judgements. This was termed the open condition and the other the closed condition.

Vurpillot used a wide age range of subjects, from 2 yrs. 11 mo. to 9 yrs. 5mo. Her oldest subjects gave near perfect performance while the behaviour of the youngest was often uninterpretable. The closed condition in the present experiment might be very difficult for pre-school age children, and so for these reasons only the middle range of Vurpillot's group will be covered here.

The expected results of this experiment are as follows:

Older children will perform better than younger ones, on both 'same' and 'different' judgements.

'Same' judgements will be easier than 'different' ones, the gap narrowing with age.

Problems involving identical or completely different pairs will be easiest, then from least to most similar pairs for 'same' judgements and from least to most different pairs for 'different' judgements.

There will be a tendency to collect too little information before making a judgement, this tendency declining with age.

The older children will collect the information in a more efficient manner than the younger.

It was thought that there might be a tendency for subjects to scan the cards from left to right and from the top down, this tendency increasing with longer instruction in reading. A final prediction is then that for instances of 'not the same' or 'not different', pairs will be easier if the falsifying information is encountered sooner using that scanning strategy, than if it is encountered later.

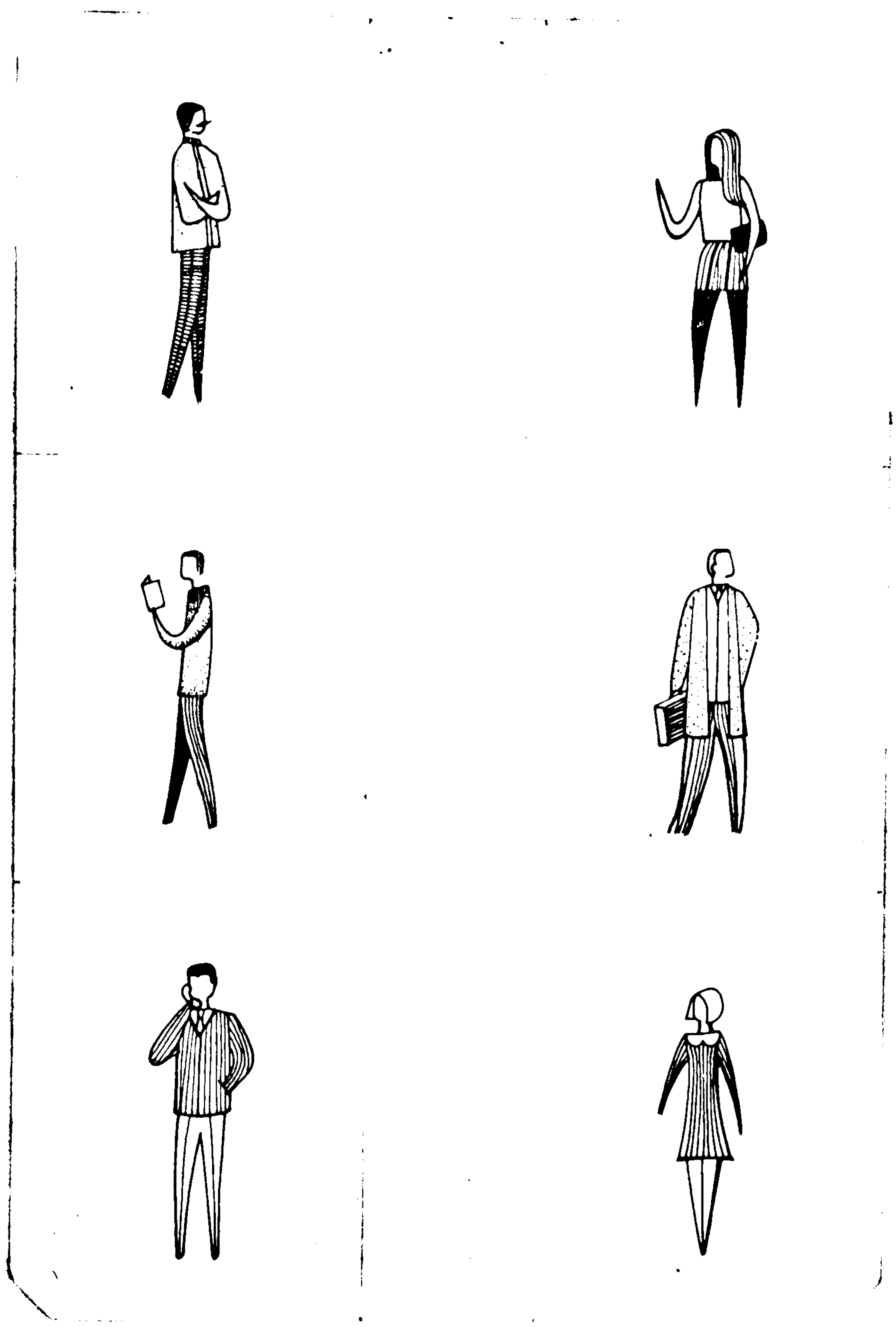


Figure 5:1. Example of stimulus card.

Method.

Subjects.

The subjects were 87 children, consisting of all children available to be tested from three classes of a local primary school. The numbers and ages in the classes were as follows:

Class	Number	Age Range	Mean Age
P1	26	4:9 - 5:9	5:3
P2	32	5:9 - 7:0	6:4
P3	29	6:10- 7:11	7:5

One child in P2, aged 6:9, was tested in the closed condition only, because of his subsequent absence. The mean age for P2 is unchanged if he is excluded.

Stimuli.

The stimuli were 6" x 4" cards, on which there were six pictures of people each about $1\frac{1}{4}$ - $1\frac{3}{8}$" high, in three rows of two as shown in Figure 5:1. The pictures were produced from rub-down transfers. A description of the experimental cards follows. Three pairs of cards were identical, in that each picture on one card was matched by an identical one in the same position on the other card, three pairs were completely different in that none of the pictures on the one card were the same as those on the other; in two pairs one picture only was matched by an identical picture in the same position on the other card, in two pairs there were three identical and three different pairs of pictures and in two pairs of cards there was only one different pair of pictures. In no case was there a picture on one card in a pair the same as one on the other, unless they occupied corresponding positions. The mixed (non-identical, not wholly different) pairs were put into two sets of three, each containing one of each kind of problem. Looking at the pictures from left to right and from the top down, different pairs are encountered earlier and similar ones later, in Set I than in Set II. There were also three pairs of cards which were used as examples, one identical pair, one wholly different pair, and a mixed pair, with three similar and three different pairs of pictures. The appearance of all the cards was such that the presence or absence, and number, of similar and dissimilar pairs could not be told at a glance, but each individual picture had to be separately fixated. The pictures to be used and the location of same and different pairs were determined randomly.

Procedure.

Each child was seen individually and given all twelve problems in one condition (six with 'same' instructions and six with 'different' instructions) in one session. Half the children received the open condition first and the other half the closed condition first. All the children in any one class were tested in one condition before any of them were tested in the second condition so for any particular child the two conditions were given on successive days or with one day intervening. Half the children were given 'same' instructions before 'different' instructions, the other half the other way round, the order being the same in both open and closed conditions. The three identical problems and either Set I or Set II were administered with 'same' instructions, and the three wholly different pairs and the other set with 'different' instructions. A child who received Set I with 'same' instructions in the open condition also did so in the closed condition. The six problems in any instruction x condition cell were administered in a random order.

The numbers of children receiving each of the eight different testing schedules resulting from the variations described above were as given in Table 5:1.

Schedule:	OSA	OSB	ODA	ODB	CSA	CSB	CDA	CDB	
P1	4	4	3	2	3	3	3	4	26
P2	3	4	4	5	4	4	4	3+1*	31+1*
P3	4	3	4	4	4	4	3	3	29
	11	11	11	11	11	11	10	10+1*	86+1*

O: open condition first   C: closed condition first

S:'same' instructions first   D:'different' instructions first

A: Set I with 'same' and Set II with 'different'

B: Set II with 'same' and Set I with 'different'.

*One child tested in the closed condition only.

Table 5:1. Distribution of testing schedules.

Due to experimenter error only two children in P1 received schedule ODB.

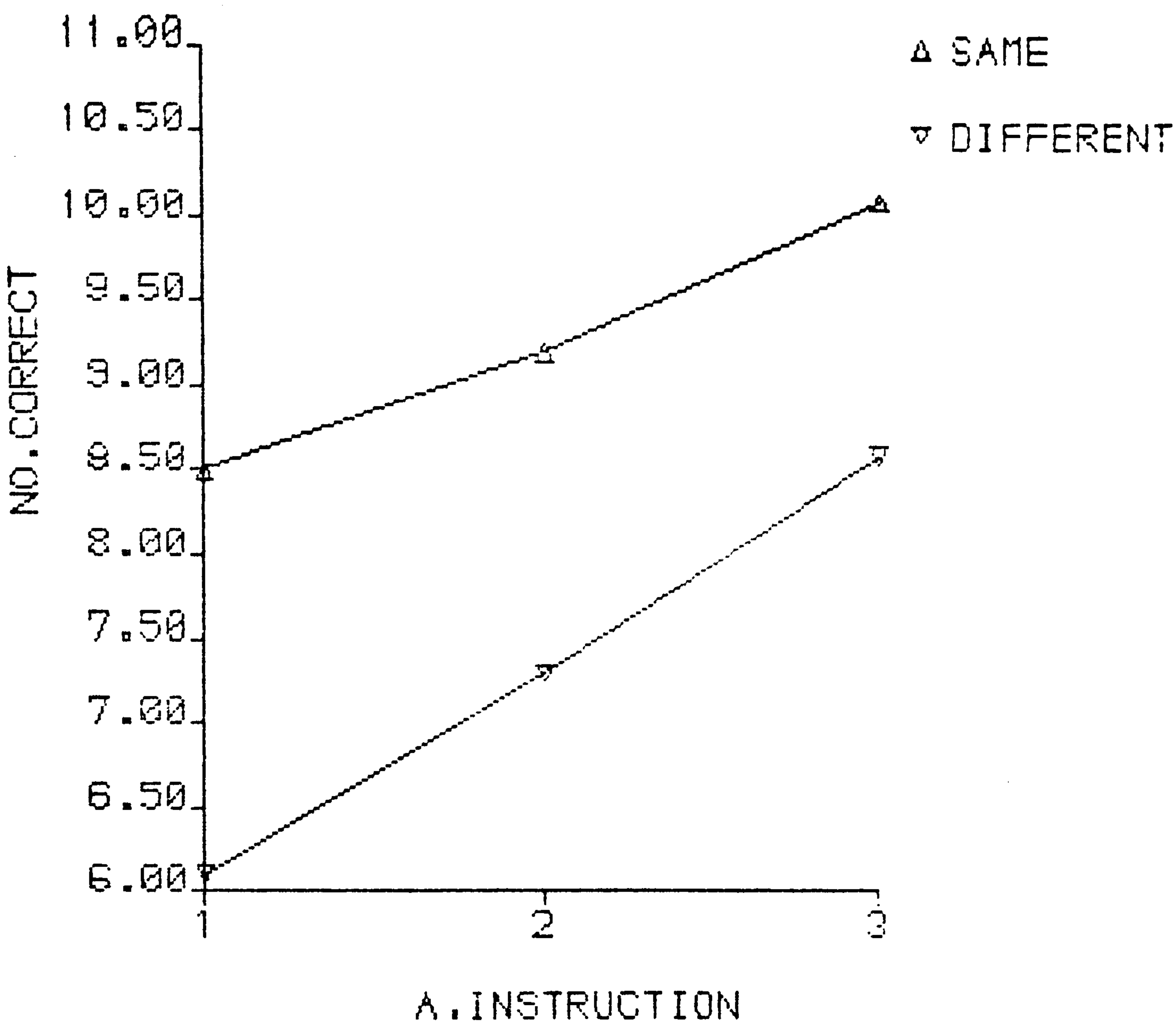
Before each set of six test problems the subject was shown two example problems, the identical pair and the mixed pair for 'same' instructions and the completely different pair and the mixed pair for 'different' instructions. These were used to indicate to the child that all six pairs of pictures had to be identical pairs for the cards to count as 'same' and all had to be different for them to count as 'different'. In the closed condition the examples were put into folders and it was explained that the child would have to open the windows. Each subject was told that 'sometimes you might have to open all the windows and sometimes you might only have to open some of them' and he was asked to declare his judgement as soon as he believed he knew the right answer. For test pairs the instructions were to say whether the two cards were 'just the same or not the same' or 'completely different or not different'. The children were not given verbal feedback on their judgements, and their answers were noted as S ('same'), D ('different')and N ('not same' or 'not different') rather than as ✓ or X. The experimenter replied 'mm-mm' and 'O.K.' to their responses in an encouraging manner. In the closed condition the windows opened and the order of opening them were also noted.

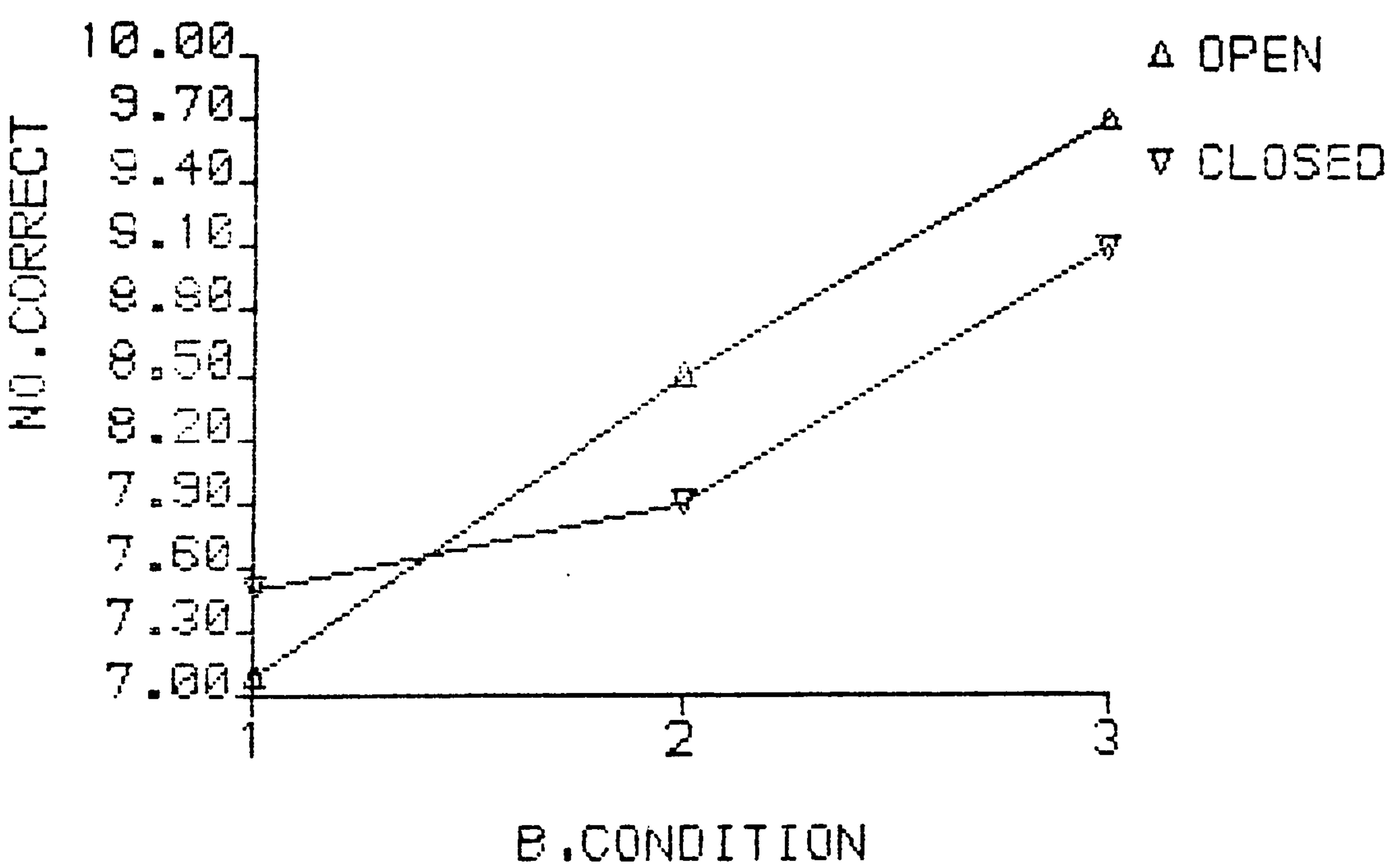
Results.

Figure 5:2 shows the number of correct responses made in answer to the different instructions and in the different conditions. An analysis of variance was carried out on the results of the 86 subjects tested in both conditions to test for the effects of age group, instruction, condition, schedule and their interactions, with the following results:

	F	df	p
Age(P1v P2v P3)	16.65	2,62	$<.001$
Schedule	1.44	7,62	n.s.
Instruction (Same v different)	54.01	1,62	$<.001$
Condition (Open v closed)	3.82	1,62	n.s.

Table 5:2. Results of analysis of variance.





Key 1:P1 2:P2 3:P3

Figure 5:2. Mean numbers of correct responses given by the different age groups, by instruction and condition.

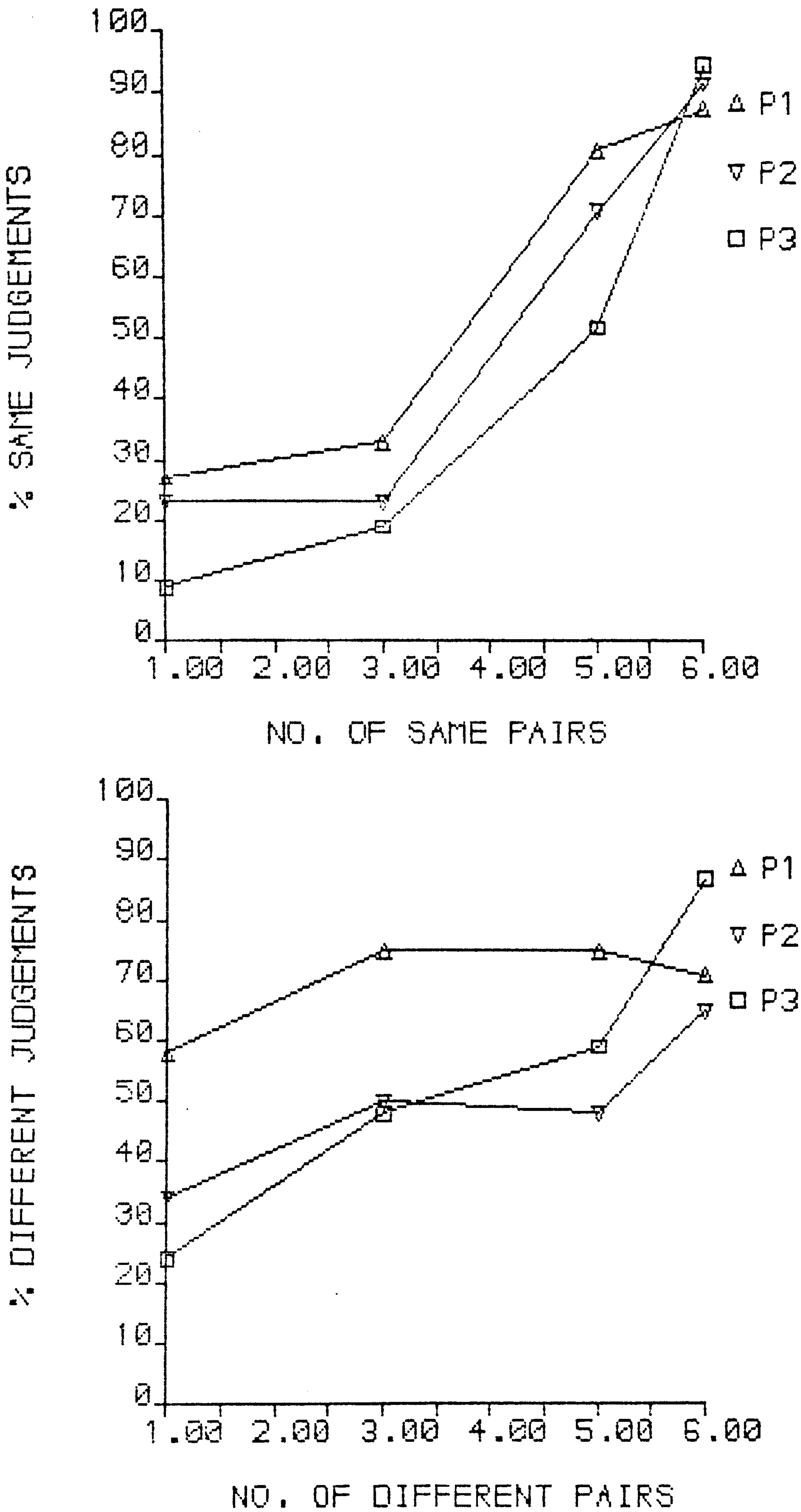
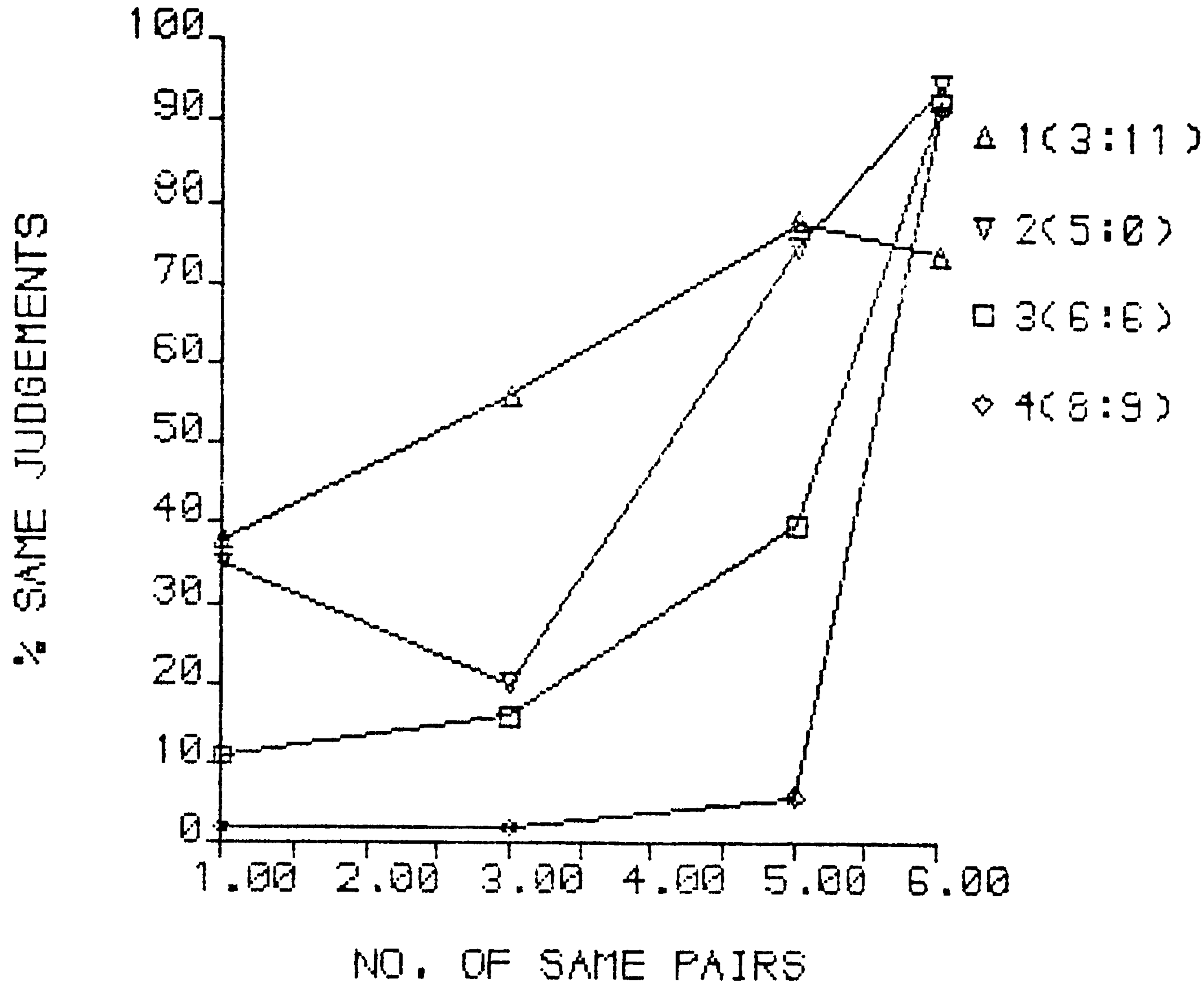


Figure 5:3 (continued over)



Mean ages of groups are given in parentheses.

Figure 5:3. Results for different kinds of problem, for 'same' condition, 'different' condition and in Vurpillot's experiment.

There were no significant interactions. A pre-planned comparison on the means for the different schedules was carried out to test for a difference between A and B schedules. This was not significant.

Differences between types of problem.

Figure 5:3 shows the responses made to different kinds of problem with Vurpillot's results for comparison. Vurpillot tested for the difference between the types by comparing identical pairs with non-identical pairs, and then the non-identical pairs with each other, in two separate analyses of variance. This has two drawbacks: it does not specifically test for order, and the range of values inserted in the latter analysis is very limited - just 0, 1 or 2 in the present case. Here the difference between the types of problem was tested in following way: Kendall's S statistic was computed for the ordering of proportion correct for the different types of problem for each child, summed over open and closed conditions but separately for 'same' and 'different' instructions. This cannot be statistically significant for individual children, since perfect ordering would be required and with the range of values available there must at least be a tie. For each group a t-test was carried out on the S scores with a null hypothesis that mean S was zero. The results, given in Table 5:3, show that the problems were ordered as expected for all groups with 'same' instructions and for P1 and P3 with 'different' instructions.

	Same			Different		
	Mean S	t	p	Mean S	t	p
P1	2.9	7.24	$<.001$	2.3	4.22	$<.001$
P2	2.6	10.54	$<.001$	0.6	1.02	n.s.
P3	2.2	6.02	$<.001$	2.3	5.29	$<.001$

Table 5:3. Results of t-tests on order of difficulty of problems.

Interpretation of 'same' and 'different'.

We now move from simply looking at whether the children's judgements are correct or not to what these judgements, and the evidence on which they are based in the closed condition, tell us about how the children are interpreting the terms 'same' and 'different'. Since the adequacy of the evidence collected by the children must be considered relative to the interpretation they are using, it will be considered in detail afterwards, but a brief digression on the topic of how the children collected the information is necessary here.

A few subjects declared their decisions having opened no windows at all, or only one, for some or all problems and could not be prompted into gathering further information. Some children opened a window on each card but not in corresponding positions - very often, mirror image pairs e.g. the top left window on the left hand card and the top right window on the right hand card. These pairs will be treated here, as the children seemed to treat them, in the same way as differences properly obtained. Determining the exact interpretation put on the terms depends on the children's responses to mixed evidence: both similarities and differences obtained for the same problem. Some children never collected mixed evidence, generally because they opened only one pair of windows for each problem.

To return to the subject of the interpretations themselves, Vurpillot found two interpretations of 'same', one requiring all pairs of windows to be the same and the other only requiring one similarity, and she classified all other responses as uninterpretable. Vurpillot's two categories will be used here, and called 'all same' and 'any same' respectively. Cases where the children never collected mixed evidence, but gave positive responses to similarities and negative ones to differences will be called 'same (unmixed)'. Then there is a group of children who although they say that some cases of mixed evidence are 'the same' and others are not, do so systematically: there is always a higher proportion of similarities in the former case than the latter. This response pattern will be called 'same (mixed)'. There are two remaining categories: those whose judgements on the basis of the evidence collected are inconsistent, and those who collect no evidence. There are corresponding categories for 'different' and in principle either 'same' or 'different' interpretations could be put on either term. The interpretations put on 'same' and 'different' in the closed condition are given in Tables 5:4 and 5:5 respectively.

	P1		P2		P3		Total	
	No.	%	No.	%	No.	%	No.	%
Same (unmixed)	8	31	13	41	10	34	31	36
All same	2	8	5	16	12	41	19	22
Any same	5	19	0	0	2	7	7	8
Same (mixed)	5	19	3	9	2	7	10	11
Total systematic	20	77	21	66	26	90	67	77
Inconsistent	5	19	4	13	3	10	12	14
No evidence	1	4	7	22	0	0	8	9
	26		32		29		87	

Table 5:4. Interpretations of 'same', closed condition.

The interpretations defined as correct, 'all same' and 'all different' respectively, increase with age. There are many more inconsistent patterns of response for 'different' than for 'same', particularly among the older children.

	P1		P2		P3		Total	
	No.	%	No.	%	No.	%	No.	%
Different (unmixed)	8	31	9	28	3	10	20	23
All different	0	0	2	6	8	28	10	11
Any different	9	35	0	0	4	14	13	15
Different (mixed)	0	0	2	6	4	14	6	7
Total different	17	65	13	41	19	66	49	56
Same (unmixed)	2	8	1	3	1	3	4	5
All same	0	0	2	6	0	0	2	2
Any same	0	0	2	6	0	0	2	2
Total same	2	8	5	16	1	3	8	9
Inconsistent	6	23	9	28	9	31	24	28
No evidence	1	4	5	16	0	0	6	7
	26		32		29		87	

Table 5:5. Interpretations of 'different', closed condition.

Although it is not possible to tell just which pictures are used as evidence in the open condition, and therefore it is not possible to distinguish with any certainty between 'all same' and 'any same' or between 'all different' and 'any different', it is possible to get some idea of the interpretation the children are using and classify this as 'same', 'different' or 'other'. In this case they are classified as 'same' if five out of six of their responses correspond to either 'all same' or 'any same' if all pictures are taken into account. This laxer criterion seems justified as it is unlikely that all pictures are considered. The results of this procedure, for the 86 children tested in the open condition are given in Tables 5:6 and 5:7.

	P1		P2		P3		Total	
	No.	%	No.	%	No.	%	No.	%
Same	21	81	29	94	29	100	79	92
Different	1	4	0	0	0	0	1	1
Other	4	15	2	6	0	0	6	7
	26		31		29		86	

Table 5:6. Interpretations of 'same', open condition.

	P1		P2		P3		Total	
	No.	%	No.	%	No.	%	No.	%
Same	6	23	8	26	3	10	17	20
Different	13	50	15	48	25	86	53	62
Other	7	27	8	26	1	3	16	19
	26		31		29		86	

Table 5:7. Interpretations of 'different', open condition.

As with the closed condition, the number of cases not assigned to a systematic interpretation is higher for 'different' instructions than for 'same' ones. In this condition one child treats 'same' as if it means 'different', as well as vice versa; he received 'different' instructions first. The results of cross-tabulating the two sets of figures are given in Tables 5:8 and 5:9.

S A M E

Closed interpretation:	Same	Inconsistent and no evidence	
Open interpretation:			
Same	63	16	79
Different	0	1	1
Other	3	3	6
	66	20	86

Table 5:8. Interpretations of 'same' in both conditions.

D I F F E R E N T

Closed interpretation:	Same	Different	Inconsistent and no evidence	
Open interpretation:				
Same	6	6	5	17
Different	0	38	15	53
Other	2	5	9	16
	8	49	29	86

Table 5:9. Interpretations of 'different' in both conditions.

Although only six subjects (7%) treat 'different' as if it means 'same' in both conditions, nineteen children altogether (22%) do so in at least one condition. The former number is made up of one child in P1, four in P2 and one in P3, while the total consists of seven children in P1 (27%), 9 in P2 (29%) and 3 in P3 (10%).

No. of windows opened.

Figure 5:4 shows the numbers of children opening different numbers of windows, summed across all problems in the closed condition.

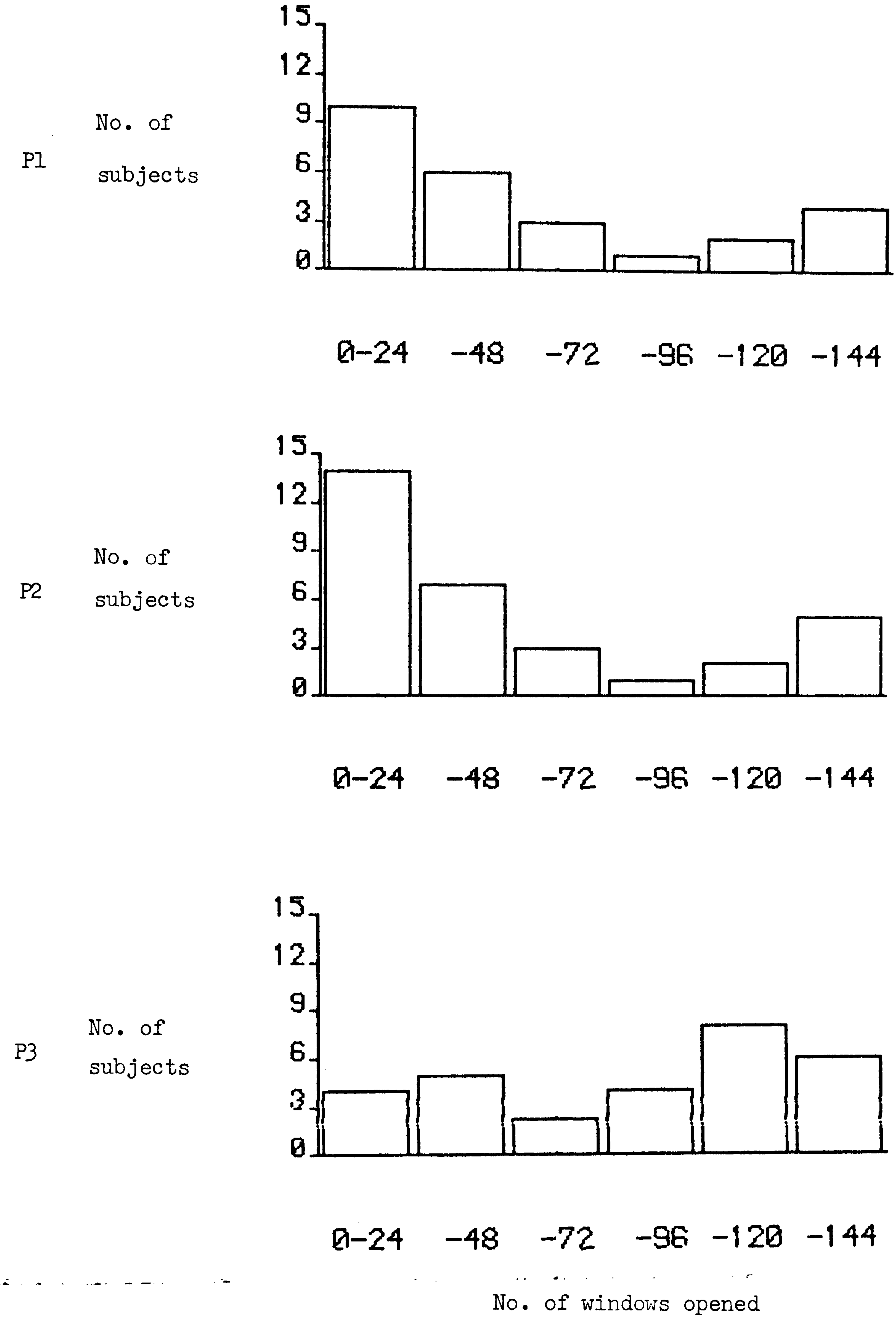


Figure 5:4. Numbers of subjects opening varying numbers of windows.

A bimodal distribution is indicated, most children either opening 48 or fewer windows in total, or more than 96 windows. Those in P1 and especially in P2 tend to fall into the former category; those in P3 are more likely to fall into the latter. A child employing the correct definitions - 'all same' and 'all different', and collecting the appropriate amount of information, will have to open all six windows on each card for the identical and completely different pairs, and on average, 1.17 pairs of windows when there are five pieces of falsifying information, 1.75 pairs when there are three similarities and three differences, and 3.5 pairs when there is only one piece of falsifying information - a total of 48.84 pairs or 97.68 windows. A child using 'any same' and 'any different' definitions will have to open the same number in total for the mixed problems, but only one pair of windows for each of the identical and completely different problems, making 18.84 pairs or 37.68 windows. A fair number of children must be opening too few windows to be sure of making correct judgements, even as assessed by the latter definitions. The difference between the three groups in the number of windows opened is statistically significant: Kruskal-Wallis analysis of variance, $H = 9.37$, $df = 2$, $p < .01$. Significantly more windows are opened in response to 'different' than 'same' instructions: Wilcoxon matched pairs signed ranks test, $Z = 2.19$, $p < .05$, 2-tailed - this is odd in the light of the greater frequency of the 'any different' interpretation relative to 'any same'.

As previously mentioned, some children did not open even one pair of windows for each problem. There were eight of these altogether (one in P1 and seven in P2) although two of them opened enough pairs of windows in response to 'different' instructions to give an indication of which interpretation of 'different' was guiding their judgement. A number of other children opened mirror image pairs or other pairs of windows which did not correspond (called mismatches below). This practice could be obscured where a lot of windows are opened - if a child opens all windows he could be thinking in terms of six mirror image pairs! - and so it may be that more of the older children, who open a greater number of windows, make such errors than is apparent.

	Mirror image pairs	Mismatches	Both	
P1	8	1	1	10
P2	6	0	1	7
P3	1	2	1	4
	15	3	3	21

Table 5:10. Numbers of children opening unmatched pairs of windows.

Table 5:10 gives the numbers of children who opened any pairs of these kinds; most of them also opened matched pairs on some problems.

The absolute number of windows opened tells us only a little about the children's information gathering performance. This can be assessed according to two criteria: Do they collect the right amount of information?,and Do they collect it efficiently? The two are not independent: a child who opens all windows on one card before any on the other for each problem is always going to collect too much information, but if he is going to open all windows on both cards regardless of what he discovers then opening all those on one first is quite efficient.

Do they collect the right amount of information?

A child who is to collect the appropriate amount of evidence must collect some for each problem, and different amounts for different problems. Many of the subjects did not do this, as Table 5:11 shows. Children who varied the number of windows they opened by not opening a pair for some problems but doing so for others are included with those who do not vary as their variation could not be systematic.

	Same		Different		
	Vary	Not vary	Vary	Not vary	
P1	10	16	8	18	26
P2	10	22	9	23	32
P3	22	7	18	11	29
Total	42	45	35	52	87

Table 5:11. Numbers of children who do and do not vary the number of windows opened.

The differences between the age groups in the number who vary in the amount of information they collect are statistically significant, both for 'same' and 'different' instructions (same, $\chi^2 = 13.53$, df = 2, $p < .01$; different $\chi^2 = 8.66$, df = 2, $p < .05$). This is mainly a difference between P3, many of whose members show variation, and the other two groups: there is actually a smaller proportion of children in P2 who vary than in P1.

A child may vary the amount of evidence he collects without this variation being systematic and dependent on what he has discovered. Included in the 'vary' totals are eight children for 'same' and four for 'different' who collect only unmixed evidence - that is, they uncovered either only similarities or only differences for any individual problem but different numbers for different problems, so there can be no system to their variation. Where a child's judgements are inconsistent on the basis of the evidence he has collected it is impossible to assess whether there was any system to his gathering of information. The exact criteria used by the children classed as 'same' (mixed) and 'different' (mixed) are not clear so that while in some cases the amount of information collected is obviously inappropriate, in others it is impossible to tell.

There remain 22 cases for 'same' instructions and 21 for 'different' who employ 'all' or 'any' definitions and vary the amount of evidence they collect. Only seven children appear in the lists for both 'same' and 'different'. Looking at which windows they open and the order in which they open them makes it possible to assess whether they stop before they have gained enough information to make a decision, at that point, or after it. At this point only pairs of windows opened are being considered - opening the same two windows on each card is treated as equivalent to the less efficient strategy of opening all six windows on one card and two on the other. In response to 'same' instructions only one child performs optimally, stopping at the right point on all six problems; he also does so to 'different' instructions as do two further children, one of whom collects the appropriate amount of evidence for five 'same' problems, the other for only two 'same' problems. All three are, not surprisingly, in P3.

It appeared when looking in detail at the subjects' protocols that some of them did not vary in the amount of evidence they collected because they were trying to relate it to the nature of that evidence but because they switched between different information gathering strategies in the course of a session. This could well be why such a small number varied the amount of evidence they collected in response to both sets of instructions.

Do they collect the information efficiently?

In order to gain the appropriate amount of information by opening the minimum number of windows, the children should make paired comparisons, as Vurpillot calls them: they should open one window on one card, then the corresponding window on the other card, and so on. However, if a child is going to open a set number of windows per problem regardless of what is discovered, as so many of them do, it does not matter in what order these are opened. Simply from the point of view of the motor actions involved it is probably most efficient to open all one is going to on one card, followed by all on the other. Even for those children who open different numbers of windows for different problems it may be that to minimise the time taken, rather than the amount of information collected, to arrive at a decision the best strategy is a mixed one - say, to open two windows on one card followed by the corresponding two on the other, and so on. All these possibilities: paired comparisons, opening a number on one followed by a number on the other, and the latter repeated, did occur, along with a few cases where the children seemed just to skip about the cards in an unsystematic fashion.

Those subjects who did not vary the amount of evidence they collected for different problems tended to use the efficient (in motor terms) strategy of opening all the windows to be opened (often just one) on one card and then all those on the other. 27 of the 28 children who opened the same number of windows for all 12 problems did so, all nine who did not vary the number opened for 'same' problems only, and ten of the 16 subjects who did not vary for 'different' problems only. (Eight subjects who opened no pairs for some problems are excluded from consideration here.)

The children who did vary the amount of information collected tended to vary the way in which they collected it also, often to a quite considerable extent. How far this variation was haphazard, and how far the result of deliberate attempts to try out different strategies, is impossible to tell. Paired comparisons, which suggest an understanding of the structure of the problems, were fairly rare, except for the special case of only one pair of windows being opened for a problem. Only twenty-five children made more than one paired comparison for any problem, and only twelve did so for six or more problems. One child used paired comparisons (one only for each of five problems) for all twelve problems. She was one of only five children who varied the amount of evidence collected but collected it in the same way for all twelve problems. Three subjects opened all six windows on one card followed by varying numbers on the other and one opened all she was going to on one followed by the same number on the other. Three subjects who varied the amount of evidence collected for 'same' problems only, and four for 'different' problems only, also used consistent strategies in gathering the information for the six problems in question.

Information collected and A and B schedules.

Finally, a note about A and B schedules. If subjects were to open the windows from left to right and from the top down they would collect the necessary information more quickly with A schedules than with B schedules. Those subjects who varied the amount of information collected and received A schedules opened a mean of 34.6 windows while those who received B schedules opened 44.0 windows on average. This difference is statistically significant (Mann-Whitney $U = 402.5$, $p < .05$ 1-tailed). This is an indication both of a tendency to use this strategy and of a tendency to relate the stopping point to the evidence collected.

Discussion

First of all the results of this study will be compared with those found by Vurpillot. On the whole they are similar: there are the same interpretations of 'same' as 'all same' and 'any same', the former increasing with age, and the same ordering of difficulty for the different kinds of problem. In both studies there is a tendency for the children not to collect enough information before making their judgements and for the younger children to be less inclined to vary the amount of information collected according to the type of problem presented than the older ones.

These similarities and also the small and statistically non-significant differences between the open and closed conditions in the present study inspire confidence that the closed condition did not critically alter the children's information gathering strategies. In so far as there were differences between the two conditions, the older groups found the open condition slightly easier and P1 the closed condition. It may be that both the possibilities mentioned in the introduction - incidental noting of pictures in the open condition and more thoughtful behaviour in the closed condition - were operating, but to different degrees for children of different ages.

One difference between Vurpillot's study and the present one is that the children here opened fewer windows than the number fixated by Vurpillot's subjects - about five per problem compared to about eight per problem for her subjects. Vurpillot does not report on the distribution of number of windows fixated but it seems unlikely that many of her subjects fixated only one pair of windows per problem - certainly she does not seem to have experienced the difficulties which led to the use of the 'same (unmixed)' category here. Also, since she analysed the scores using an analysis of variance it seems unlikely that the distribution was bimodal, as found in this chapter.

From the point of view of the present work the most important results are those comparing 'same' with 'different' instructions. 'Different' was, as expected, more difficult than 'same'. The overall difference in number of correct responses is contributed to by two different interpretations of 'different', as 'any different' and as 'same'. The two together make for the greater flatness of the curves in Figure 5:3B compared to those in Figure 5:3A, and result in there being no difference between the different kinds of problem in the number of correct responses made by children in P2.

The 'any different' interpretation will be considered first. The example problems which were shown to the children in some detail were intended to make clear to them that all six pairs of windows had to be the same for the pair of cards to count as 'same' and all six had to be different for them to count as 'different'. The 'completely different' interpretation may however be more difficult than the 'just the same' one for two reasons. Firstly, the use of 'same' to mean 'identical' is quite common in ordinary language, while the use of 'different' to mean 'different in all relevant aspects' is not common and many children may have adhered to a more natural interpretation of 'different' as 'having some relevant difference'. The other possible reason for the greater difficulty of 'different' is indicated by the paraphrases given above. Two objects which are 'just the same' are identical in all readily observable attributes save location; two objects are never 'completely different': difference is always relative to some notion of which attributes are relevant and which are not.

It was expected that a few children would interpret 'different' as meaning 'same' but it turned out to be more common than anticipated. Several children showed this interpretation in only one of the testing sessions and some of these interpreted the term as 'different' in the other session. This means that the numbers found here must be a conservative estimate of the number of children who would ever interpret 'different' as 'same'. It was noted that a greater number of children gave inconsistent responses to 'different' instructions than to 'same' ones: some children may have been shifting from one interpretation to the other within a single session.

One respect in which the children's performance was better on 'different' problems than on 'same' ones was that they opened a greater number of windows. This could have been because they realised that it was appropriate, or they may simply have felt a need for more information when they were uncertain about their responses.

The number of children treating 'different' as 'same' is greater than that found in either Chapter 3 or Chapter 4 and this is only partly due to there being two testing sessions in which such an interpretation may be evinced. They are, of course, a different group of subjects, but there is no reason to expect them to be poorer performers. Their general background is intermediate between those of the subjects used in those experiments. There seems to be little in the task which would encourage the interpretation of 'different' as 'same'. Possibly it requires less thought simply to judge whether two objects are different or not rather than to select a different object or say what is different about two objects and the results might be the consequence of carelessness. This would also account for the greater preponderance of this interpretation in the open condition than in the closed condition.

Chapter 6. Further experiments on the selection and judgement of 'same' and 'different' items.

Introduction.

So far in this section two experiments have been described, involving two rather different tasks. In the experiment described in Chapter 4 the subjects had to select from an array an item - a card with one or two geometric figures drawn on it - that was either the same as, or different from, a target item, and then they had to justify these choices. In the experiment described in Chapter 5 all the subjects had to do was to judge whether two items were the same or not, or were different or not. Described in this way, the second task seems much simpler but of course it was made more complicated by requiring the subjects in one condition to open little card windows to see parts of the items and by the complex nature of the stimulus items themselves - each consisting of six pictures and each of these individual pictures being more complex than the geometric figures used in Chapter 4's selection task. All the relevant aspects of one of those geometric figures can be taken in at a glance, but this is not true of the sets of human figures used in the judgement task. A corollary of this is that a subject can pick out a 'same' or 'different' item without referring back to the target geometric figure whereas he may have to look back and forth several times to judge whether two of the sets of human figures are the same or different.

The stimulus set in Chapter 4 was constructed by taking all the possible combinations of two values for each of four properties, all the values employed probably soon becoming apparent to the subjects. For Chapter 5's stimulus set locations take the place of properties and particular figures the place of values of properties. Even this comparison is not exact as the values of one property cannot be the same as those of another - only colour can be red or blue! - while it is possible, and was indeed the case, that a figure appearing in one position on one card could be in a different position on another card (though such a situation never arose within a pair of cards). In all there were 18 different figures used, and four of these could face either to the right or to the left, making twenty-two variations altogether. It is extremely unlikely that any child was ever aware of just what was the range of figures available.

It was found that a higher proportion of children in the experiment described in the previous chapter treated 'different' as if it meant 'same' than in the earlier experiments, and it was suggested that this might be because the experiment was so simple. A possible argument is that when the meaning of a term is first acquired it can only be used consciously but is later routinised and available for relatively automatic use. The judgement task may be so simple that it is performed automatically and some children are led to make judgements in terms of 'different' interpreted as 'same' because of this, because only this meaning, acquired earlier, is available to lower levels of functioning. It was noted that the children were more likely to treat 'different' as 'same' in the open than in the closed condition in the previous experiment. As the open condition should be the easier of the two this is consistent with the above line of argument.

It cannot be ruled out however that the difference arises, not because the judgement task is easier than the selection task, but because it is more difficult - more difficult by virtue of the nature of the stimulus materials involved. In this case the argument would again be that the more recently acquired interpretation of 'different' as 'different' is only available when the child is paying conscious attention to the word, and that he may not do this if great demands are made on his attention from elsewhere.

Either of these explanations assumes that it is possible for one and the same child to interpret 'different' as if it meant 'same' on some occasions but to interpret it correctly on others. This appeared to be happening in the experiment reported in Chapter 5, some children apparently changing their interpretation of the term from one condition to the next.

An obvious test of the alternative explanations that the rate of this particular error was high in the previous experiment because of the easiness of the task or because of the difficulty of dealing with the stimulus materials, is to separate task from materials, and see what the effects are of children attempting a judgement task with simple stimuli or a selection task with complex materials. The two experiments to be described in the present chapter are attempts to do just this.

The sets of cards used in Chapter 4's selection task are suitable for use in a judgement task. It should however be noted that one of the properties of the geometric figures, number, differs from the others: colour, shape, and pattern, in that it is not a property of a single figure. Because of this difference it is excluded from the experiment to be described in this chapter and only those cards with a single geometric figure are used. This maximises the contrast between this stimulus set and the one used in the previous experiment, one consisting of pictures, the other of groups of six pictures. In this case it is possible to have pairs of cards with 3, 2, 1 or 0 properties in common, compared with the 6, 5, 3, 1 or 0 pictures in common possible for the cards used in the previous chapter. That is, there are only two kinds of 'mixed' pairs available, in addition to identical and completely different pairs. In this experiment, unlike the previous one, identical and completely different pairs are used as negative exemplars of 'different' and 'same', as well as as positive exemplars of the opposite terms. It was argued in the previous chapter, following Vurpillot (1968) that differences in difficulty between problems of different types were due to differences in likelihood that a judgement based on too little information would be wrong. This argument would not predict any difference in difficulty between identical and completely different pairs in the same condition.

Unfortunately, the sets of cards used in the judgement task in Chapter 5 are not suitable for use in a selection task. Such a task requires an array of cards structured as a whole, while those cards were constructed as a series of pairs, with no regard for the relations between cards which were members of different pairs. If used for a selection task the number of cards with a given number of pictures in common with a target would vary depending on the target and the presence of mirror images and identical figures in different locations would further confuse the issue. Accordingly a new set of cards is used in the present experiment, each of these also having six individual pictures on it, and such that for any target card there is the possibility of choosing cards with 6, 4, 2 or 0 pictures in common with it.

Some of the results of these experiments have already been presented in the appendix to Chapter 3, as the subjects employed there on Claparède's task all participated in one or other of the present experiments and the results were used to shed some further light on the outcome of the main experiment of that chapter. It seemed unwise to make those subjects carry out both the tasks of the present chapter as that would mean them each participating in three experiments. The experiment reported in Chapter 4 included pre-school-age subjects; that in Chapter 5 did not as it was thought to be too difficult for them. Pre-school subjects are used in the present experiments, most of them taking part in both so as to investigate whether their performance differs from one to the other. Following this introduction, the two experiments are reported and then this comparison between the two for the youngest subjects is made, and finally there is a general discussion.

The two main points at issue are, will either of these experiments show the same level of systematic misunderstanding of 'different' as 'same' as found in Chapter 5? (and if so, will it be the experiment using the same task or that involving the same kind of stimulus materials?) and will any of the children who participate in both experiments treat 'different' as 'different' in one of them and as 'same' in the other?

It is also of interest whether other findings of Chapters 4 and 5 are replicated in these experiments. Improvement with age and better performance with 'same' than with 'different' instructions, in selection and judgement though not necessarily in justification, are expected. Other findings of Chapter 4 concerned the similarity of both 'same' and 'different' selections to the target, the tendency for children in the middle of the age range to make the most dissimilar 'different' choices, the varying influence of the different properties and the differing proportions of different kinds of justification given for 'same' and 'different' selections. Chapter 5 found differences in difficulty between different kinds of problem, and a tendency to judge pairs to be different when there was any point of difference.

Expt. 1. Judgements of sameness and difference of geometric figures.

Method.

Subjects.

There were four groups of subjects totalling 45 in all, made up as follows:

Group	Number	Age range	Mean Age
P	13	3 yrs 0 mo - 4 yrs 7 mo	3:9
J1	13	5 yrs 1 mo - 6 yrs 1 mo	5:8
J2	9	6 yrs 6 mo - 7 yrs 6 mo	6:11
J3	10	7 yrs 1 mo - 8 yrs 6 mo	7:9

Group P was drawn from the psychology department playgroup. Groups J1, J2 and J3 were drawn from the three classes of an independent school involved in the experiment described in Chapter 3. Every alternate subject to be tested in that study participated in this one.

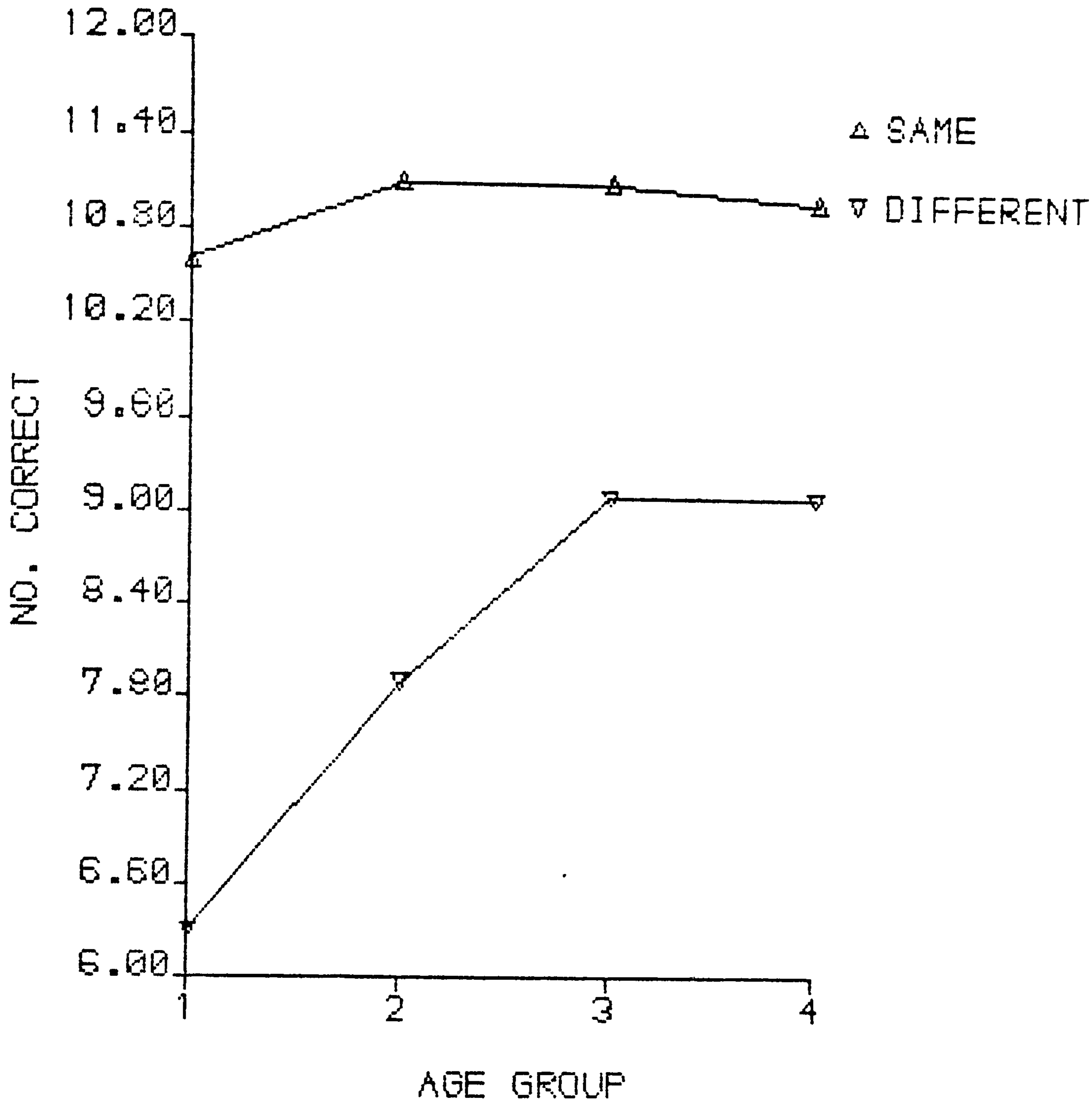
Materials.

The materials used were the sets of cards with geometric figures drawn on them described in Chapter 4, save that only those cards depicting single figures were used.

Procedure.

The children were tested individually, seated beside the experimenter at a table, on which the cards were placed. The school children performed the task immediately after Claparède's task; the playgroup children carried out this task a few days before taking part in the other experiment to be described in this chapter.

Each child was tested on 12 'same' problems and 12 'different' problems, half the subjects receiving all 'same' problems before the 'different' ones and half in the reverse order. The 'same' problems consisted of six pairs of identical cards, two pairs of cards showing geometric figures with two properties in common, two pairs with one common property and two pairs with no properties in common. The 'different' problems consisted of two pairs of identical cards, two pairs with two common properties, two pairs with one common property and six pairs with no properties in common. Each group of twelve problems was arranged in two blocks of six, each block containing three identical or completely different pairs, as appropriate, and one each of the other kinds. Apart from this constraint the order of problems was random and the cards making up the pairs were also determined randomly. Before each group of twelve problems the child was shown two example problems, an identical pair and one with just one common property before 'same' problems, and a completely different pair and one with two common properties before 'different' problems. These examples were used to stress to the child that the figures had to be the same in all three properties to count as 'same' and different in all three properties to count as 'different'. For test problems the instructions were 'Are these two just the same or not the same?' and 'Are these two completely different or not different?' as appropriate. Occasionally a child would change his mind about his judgement. In these instances the final decision was accepted. Sessions were tape-recorded and any remarks made by the subjects which related to the task were later transcribed.



Key 1:P 2:J1 3:J2 4:J3

Figure 6:1. Mean number of correct responses given by the different age groups.

Results.

Age and number of correct judgements.

Figure 6:1 shows the number of correct 'same' and 'different' judgements made by the different age groups. Kruskal-Wallis analyses of variance to test for the effects of age group were performed on the 'same' scores, the 'different' scores and on the differences between these two scores for each subject, the last to test for an interaction. None gave statistically significant results (Same, H = 0.52, n.s.; Different, H = 7.37, n.s.; Same - Different, H = 4.15, n.s.). Performance on 'same' judgements is high throughout and Figure 6:1 would lead one to expect a non-significant outcome. The result for 'different' judgments has a chance probability of $<.01$ and given that in no case does an older group perform less well than a younger one, and that no account is taken of this order information in the analysis it might be accepted that there is a real difference between the groups.

Responses to different types of problem.

Figure 6:2 shows the proportions of different kinds of judgement for different kinds of problem. The different types of problem do not exactly match the different types used in the previous experiment. In that case pairs of identical cards were used only with 'same' instructions and pairs of completely different cards only with 'different' instructions, there being three kinds of 'mixed' problem used with both instructions. In this case there are only two kinds of 'mixed' problem, those with one and two common properties and identical and completely different pairs of cards are used with both 'same' and 'different' instructions. The rationale given for there being differences in difficulty between the 'mixed' problems and between these and the identical

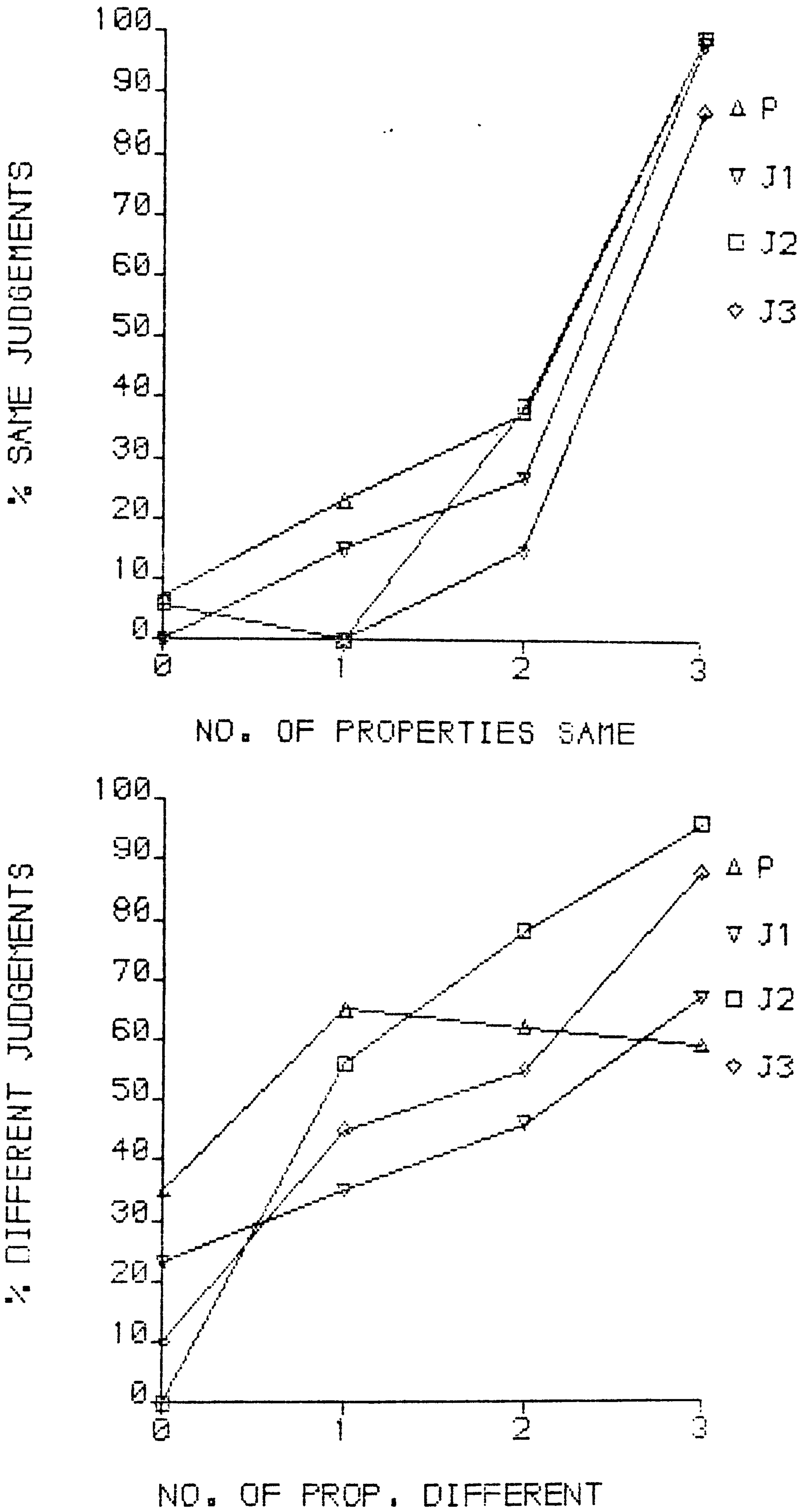


Figure 6:2. Results for different kinds of problem, in 'same' and 'different' conditions.

and completely different pairs would not lead one to expect any difference between these last two types when used in the same condition, and so they are grouped together for the purpose of testing for differences between problems of different types. Table 6:1 gives the percentages of correct responses for the different types.

	Same					Different				
No. of common properties:	3	0	3 + 0 combined	1	2	3	0	3 + 0 combined	1	2
% correct	97	97	97	89	70	81	75	77	41	50

Table 6:1. Percentages of correct responses to different types of problem.

Differences between the types of problem were tested for statistically in the same way as in the previous chapter. Kendall's S statistic was computed for each child as a measure of the extent to which his proportions correct for the different kinds of problem fell in the expected order, and t-tests were then carried out for each age group to test the null hypothesis that the mean value of S was zero. The results of this procedure are given in Table 6:2.

	Same			Different		
	Mean S	t	p(1-tailed)	Mean S	t	p(1-tailed)
P	1.08	3.35	<.01	0.77	1.39	n.s.
J1	0.77	1.96	<.05	0.46	0.71	n.s.
J2	1.00	2.83	<.05	1.89	5.76	<.001
J3	0	0	n.s.	1.00	1.59	n.s.

Table 6:2. Tests for differences between types of problem.

As can be seen, for 'same' judgements there were significant differences between the types of problem for all groups except J3 but only for J2 for 'different' judgements.

Interpretations of 'same' and 'different'.

The children's judgement patterns give an indication of the interpretations of 'same' and 'different' they are using and these will now be considered. The procedure in this experiment corresponds to the open condition in the study reported in the previous chapter, in that the pairs of cards were put before the children without any covers. However, in this case if a child looks directly at a card at all, he will see all three properties, whereas in the former case it was necessary to fixate each picture individually. It should be the case that the evidence on which a judgement is based always consists of all the evidence - the values on each of the three properties for both cards - but just because the child must see all the information does not mean that he attends to each property, or considers it in arriving at his judgement. For this reason, criteria of less than 100% of judgements consistent with a particular definition were adopted in deciding the interpretations used by the subjects. In principle any definition may be used for either term. The children's responses were classified as follows:

All same — All properties have to be the same for the pair of cards to be judged 'same' or 'different' - the correct interpretation for 'same'. Criterion: at least 11 out of 12 judgements consistent with this interpretation.

Any same — A pair of cards is judged 'same' or 'different' if they have the same value on any of the three properties. Criterion: at least 11 out of 12 judgements consistent with this interpretation.

Other same — Interpreting 'same' or 'different' as 'same' in some sense but further definition not possible. Criterion: at least 7 out of 8 judgements of identical and completely different pairs consistent with interpretation as 'same', but not falling under either of the above categories.

All different	
Any different	As corresponding 'same' definitions, mutatis mutandis.
Other different	
Other	Fewer than 7 out of 8 judgements of identical and completely different pairs consistent with either 'same' or 'different' interpretations.

The results of this classification for 'same' interpretations are given in Table 6:3.

	P		J1		J2		J3		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
All same	8	62	10	77	6	67	7	70	31	69
Any same	2	15	2	15	0	0	0	0	4	9
Other same	2	15	1	8	3	33	1	10	7	16
Other	1	8	0	0	0	0	2	20	3	7
	13		13		9		10		45	

Table 6:3. Interpretations of 'same'.

There is no clear pattern to the 'all same' scores in the different age groups but only in the two younger groups are there any 'any same' cases. Oddly, a higher proportion of the two older groups fall into the 'other same' and 'other' categories.

The three children classified as 'other' can be looked at more closely. The youngest of these, a child in P, judged all pairs of cards to be 'same'. She is not simply a yea-sayer, as she did not behave in this way when making 'different' judgements. She may be basing her judgements on some very general property - for instance, that the cards are the same because both members of each pair show geometric figures. It seems clear that the two older children, in J3, are at the opposite extreme. Their only errors are on identical pairs, one judging two of them and the other five of them, to be 'not the same'. Remarks they made spontaneously during testing indicate that their judgements were based on genuine, but, to the experimenter, irrelevant differences.

The interpretations the children appeared to be using for 'different' are as given in Table 6:4.

	P		J1		J2		J3		Total	
	N	%	N	%	N	%	N	%	N	%
All different	0	0	2	15	2	22	4	40	8	18
Any different	4	31	2	15	5	56	5	50	16	36
Other different	3	23	3	23	2	22	0	0	8	18
Total different	7	54	7	54	9	100	9	90	32	71
All same	2	15	2	15	0	0	1	10	5	11
Any same	1	8	0	0	0	0	0	0	1	2
Other same	1	8	0	0	0	0	0	0	1	2
Total same	4	31	2	15	0	0	1	10	7	16
Other	2	15	4	31	0	0	0	0	6	13
	13		13		9		10		45	

Table 6:4. Interpretations of 'different'.

The correct 'all different' interpretation slowly increases in popularity with age but is never as common as 'any different'. The various 'other' classifications - 'other same', 'other different' and 'other' are more numerous than for 'same' interpretations but are this time more common in the two younger age groups.

The three 'other' cases for interpretations of 'same' were all thought likely on closer inspection to be treating the term as meaning 'same' in some sense, although they did not satisfy the criteria set up. Similarly, it may be that four of the six 'other' cases for 'different' may in some way be treating the term as meaning 'different'. Corresponding to the child who declared all twelve pairs to be 'same' in that condition, one of the children in J1 declared all twelve pairs to be 'not different'. She scored 11 out of 12 correct for 'same' (and was therefore classified as 'all same') so she is not just giving a negative response to each problem. As with the other child, she may be basing her answers on some general similarity, such as being geometric figures, which prevent her from acknowledging the pairs to be 'completely different'. Three other cases, 1 in P and 2 in J1, score 6 out of 8 for the identical and completely different pairs and varied numbers for the other problems. This just fails to meet the criterion and could be due to carelessness. In the summary of this experiment in the appendix to Chapter 3, both of these subjects in J1 were accepted as understanding 'different'.

The remaining two 'other' cases for different, one in P and one in J1, defy explanation. The response patterns for these subjects are identical and evenly divided between right and wrong answers for all types of problem: one correct and one incorrect judgement for the pairs with three, two and one common properties, and three right and three wrong for the completely different pairs.

Cross-tabulating the findings for the interpretations given to 'same' and 'different' results in Table 6:5. No child appears in the 'other - other' cell in this table. This is in line with the suggestion that the subjects classified as 'other' for 'same' do actually understand the term, as if they did not, one might expect them not to understand 'different' either.

Interpretations of 'different':	Interpretations of 'same'		
	Same	Other	
Same	7	0	7
Different	29	3	32
Other	6	0	6
	42	3	45

Table 6:5. Cross-tabulation of interpretations of 'same' and 'different'.

Effect of different properties on responses.

Next we come to consider the influence of the different properties, colour, shape and pattern, on the children's responses. The percentages of correct responses,i.e. 'not the same' and 'not different', when those pairs with only one or two properties in common had a particular property in common, are given in Table 6:6.

	Same			Different		
	Colour	Shape	Pattern	Colour	Shape	Pattern
One common property	100	74	96	39	43	44
Two common properties	85	59	68	44	65	50

The figures for 'two common properties' are derived from the following percentages:

	Same			Different		
Properties common:	Colour and Shape	Colour and Pattern	Pattern and Shape	Colour and Shape	Colour and Pattern	Pattern and Shape
	77	91	47	58	34	71

Table 6:6. Correct responses by common properties.

All three percentages for 'different' problems with one property common are rather similar. Otherwise the pattern is consistent: pairs of the same shape are most likely to be judged 'same' or 'not different', pairs of the same colour are most likely to be judged 'not the same' or 'different' and pairs of the same pattern are intermediate.

Spontaneous remarks.

Although the children were not asked to justify their judgements some of them did so spontaneously, or made other remarks about the pairs of cards. The corpus of spontaneous remarks will be considered here.

Most of the remarks were straightforward justifications e.g. a child judges a red striped circle and a blue spotted square to be 'not the same' and goes on 'That's a round and that's a square and that's got stripes and that's got spots'. Because these justifications are not available for all subjects they will not be considered further.

One child in P who is classified as treating 'different' as 'same' clearly uses the term with this meaning. She says of two blue spotted squares 'That one's a square and that one's a square, they are different' and of a blue spotted square and a blue spotted circle, 'Those aren't different, that one's a square and that one's a ball'. Another child in P, the one who declared all 'same' pairs to be the same, makes some puzzling remarks. After confidently making her judgement she several times went on to say that one of a pair of cards was the same and the other was not, or that one was different and the other was not. She was classified as understanding 'different' on the basis of her judgement pattern (though she fell into the 'other different' category) and one was inclined to say that she understood 'same' also but these remarks indicate that her understanding of the terms is at best imperfect. It will be necessary to refer to this child again and the initials KT will be used to identify her.

A child in J2 provides an ingenious justification for judging a red striped circle and a blue spotted square to be the same. Before making her judgement she said 'Well the lines there and the lines there', pointing to the outline of the square and the stripes on the circle. She was prompted to give a judgement and after doing so she said 'Because that's round and those are round', referring this time to the outline of the circle and the spots on the square. This child made only one other error in her 'same' judgements, in that she judged two spotted circles, one red and one blue, to be the same, adding afterwards 'Cos, but this one is red and this one's blue'. There are three other children among those who contribute to the spontaneous remarks corpus (one each in P, in J1 and in J2) whose only error is judging two figures of the same shape and pattern, but not colour, to be the same and each of these comments on the fact that there are different colours. The clearest case is the child in J2 who says 'They are same but they've got the different colours'. This type of problem, with only colour not common, was the only 'same' problem to elicit fewer than 50% correct responses. For some children at least, it is not that they have either not noticed or not remembered the different colours, but that they think them unimportant.

There are two other children who comment on differences in cards which they have judged to be the same. One of these is wrong on both problems with two common properties. For one pair it is, once again, colour which is not common and for the other pair it is shape; in both cases she comments on the differences. The remaining child incorrectly judges three pairs of cards to be the same, two of which have only shape in common and one both colour and shape and in one of the former cases she comments that only one card has dots. So altogether the instances where the children judge a pair of cards to be the same but then remark on differences between them amount to five for differences in colour and one each for differences in pattern and shape.

Expt. 2. Selection and justification of same and different items using complex stimuli.

Method.

Subjects.

There were 43 subjects divided into four groups as follows:

Group	Number	Age range	Mean Age
P	11	3 yrs 0 mo - 4 yrs 8 mo	3 yrs 11 mo
J1	10	4 yrs 9 mo - 6 yrs 3 mo	5 yrs 7 mo
J2	11	6 yrs 3 mo - 8 yrs 2 mo	6 yrs 10 mo
J3	11	7 yrs 4 mo - 8 yrs 11 mo	8 yrs 1 mo

Two children, one in P aged 3 yrs 7 mo and one in J1 aged 4 yrs 9 mo did not complete the task. If they are excluded the mean age of P is unchanged but that of J1 becomes 5 yrs 8 mo.

The children in group P were drawn from the psychology department playgroup and ten of them participated in experiment 1 also. The J groups consist of those children who acted as subjects for the experiment reported in Chapter 3 who did not take part in experiment 1. It was noted in Chapter 3 that one child was tested but his responses not included in any analysis because his understanding of English did not seem adequate to the task. He seemed quite able to cope with the selection task and so he is included here - at 8 yrs 11 months he was the oldest subject to be tested.

Materials.

The materials consisted of two identical sets of six cards, each card having on it six coloured pictures of birds, in two rows of three, produced by rub-down transfers. Figure 6:3 shows an example. The cards measured 12 cm x 8 cm, the individual pictures occupying most of their allotted 4 cm x 4 cm space along at least one dimension. There were in all twelve different bird pictures and they were assigned to different cards in such a way that for any one card the remainder of the set of twelve consisted of one identical card, four cards with four of the same birds on, four cards with two of the same birds on, and two completely different cards.

Procedure.

Each child was seen individually, seated beside the experimenter. The school children performed the task immediately after Claparède's task, the playgroup children a few days after Expt. 1, for those who took part in that experiment.

All twelve cards were laid out on a table in front of the child in a haphazard manner. Half the children made 'same' selections first and the other half 'different' selections first, all those of one kind being made before any of the other kind. The experimenter picked up a card from the table and asked 'Can you find me one that's the same as (different from) this?' and when a selection had been made 'How are they the same (different)?' Each of the six different cards was used as a target for both same and different selections, the experimenter picking up the cards in a pre-determined random order.

If a child later rejected a card he had picked out only the choice he eventually accepted was taken account of in analysis. All sessions were tape-recorded for later transcription and the experimenter made notes as to which birds were pointed to by the children where this was necessary to clarify their justifications.

Prompts were used where a child did not make a selection or a justification, or where the justification offered would be considered a 'no response'.

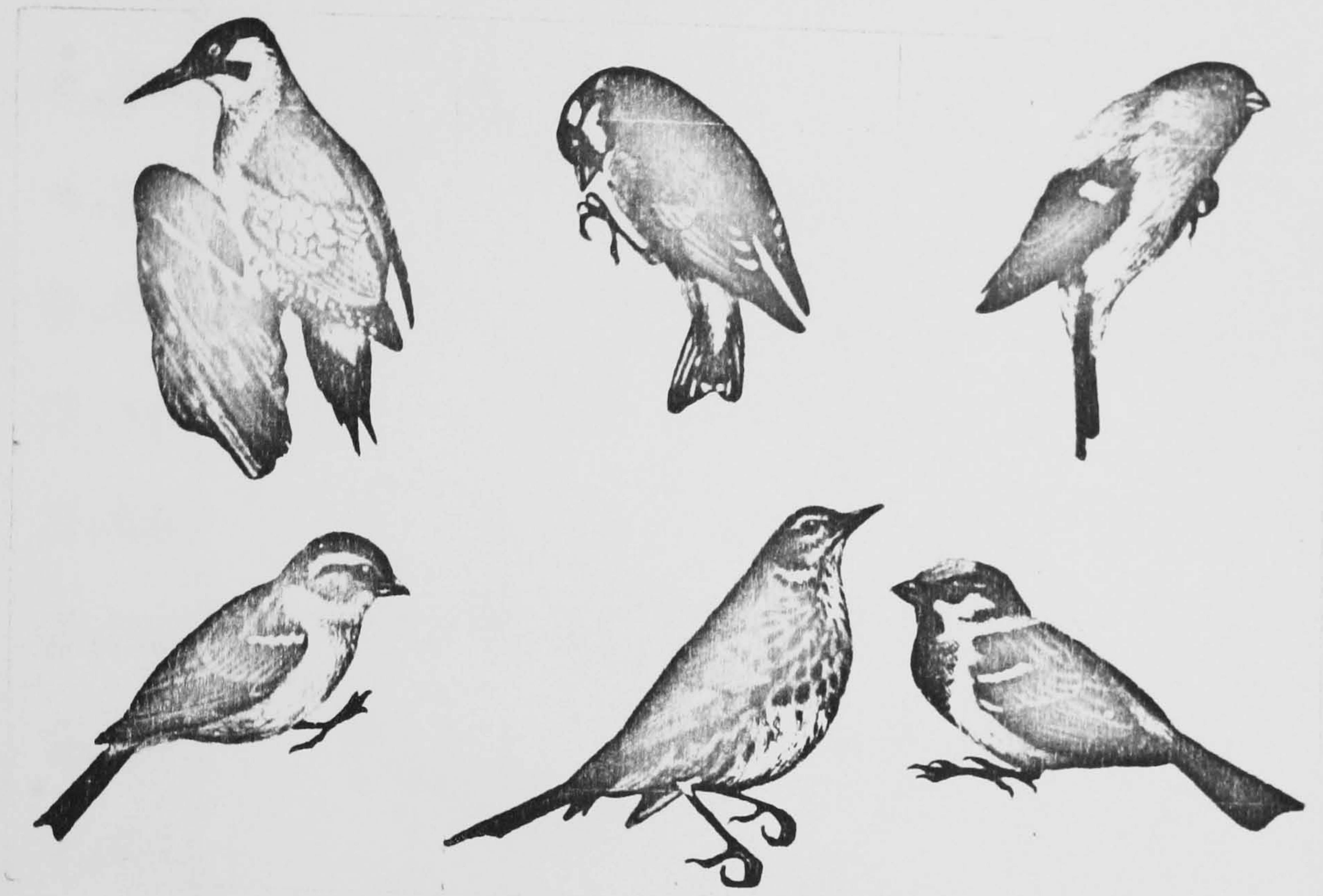
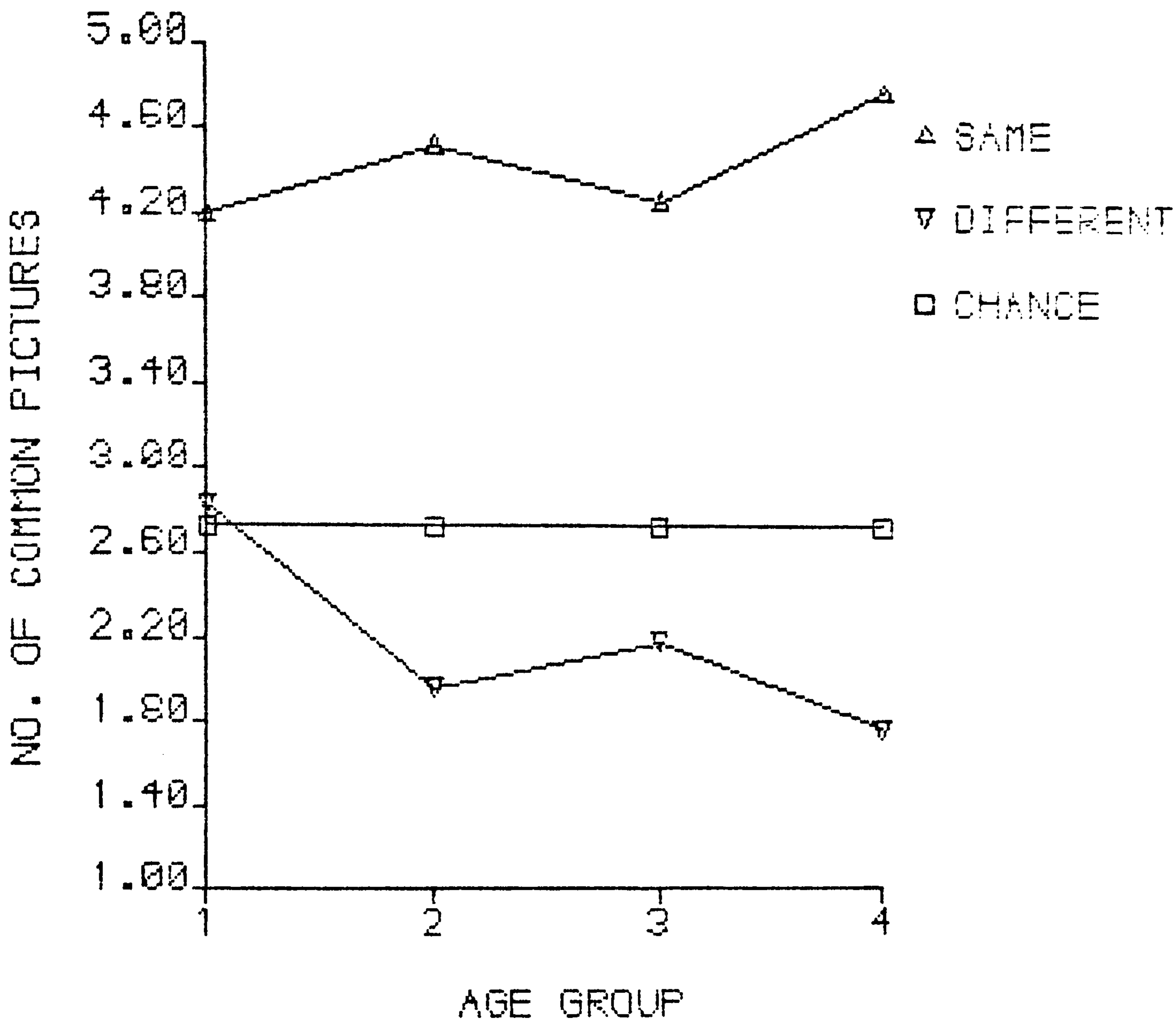


Figure 6:3. Example of stimulus card for selection experiment.



Key 1:P 2:J1 3:J2 4:J3

Figure 6:4. Mean number of pictures common to target and selections.

Results.

Selections.

All children save two made all twelve selections requested. One child in P refused to make one 'different' choice and one in J1 made only two 'same' selections.

Effect of age on similarity of selections.

Figure 6:4 shows the mean number of pictures in common between target and selection for the different age groups in response to the two instructions. These figures are based on the results for 41 subjects for each instruction, the two children mentioned above being dropped. Kruskal-Wallis analyses of variance were carried out on the mean number of common pictures for each child, for 'same' selections, 'different' selections and the difference between these two, to test for age effects and in the last case, for an age by instruction interaction. None gave statistically significant results, although the last two came close to it. ('Same', $H = 2.05$, n.s., 'Different', $H = 7.33$, n.s., 'Same' - 'Different', $H = 7.28$, n.s., d.f. = 3 throughout.)

Effect of instruction.

Figure 6:4 clearly indicates a difference in the number of common pictures between 'same' and 'different' choices. In all, 39 children had a higher mean number of common pictures for their 'same' selections than their 'different' selections and for only one child (in P) was the reverse true. 'Same' selections seem to be more similar to the target than would be expected by chance, while 'different' selections, although dissimilar to the target rather than otherwise, are little different from chance.

As in Chapter 4 it is possible to discover whether an individual's selections are significantly more similar to, or more dissimilar from, the target than would be expected by chance. The results of this procedure are given in Table 6:7.

<u>Same</u>	No. of subjects whose 'same' selections are significantly similar to target $p < .05$.	% of group
P	4	36
J1	4	44
J2	4	36
J3	7	64
Total	19	45

<u>Different</u>	No. of subjects whose 'different' selections are significantly dissimilar from target $p < .05$.	% of group
P	0	0
J1	3	30
J2	2	18
J3	3	27
Total	8	19

<u>Table 6:7. Subjects who make significantly similar or dissimilar selections.</u>

The numbers of such subjects are more than twice as great for 'same' selections as for 'different' ones.

It is also possible to test whether an individual child is distinguishing between his 'same' and 'different' selections in the no. of pictures common to target and chosen card. Sign tests on their selections have the results given in Table 6:8.

	P	J1	J2	J3	Total
No. of subjects whose 'same' and 'different' selections are different, $p < .05$	3	6	5	7	21
% of group	30	67	45	64	51

Table 6:8. Subjects whose 'same' and 'different' selections differ significantly.

About half the subjects distinguish between their selections in this way.

There may of course be nothing wrong with a child's selections, even if neither his 'same' nor his 'different' selections are different from what would be expected by chance, or different from each other. The only absolutely wrong choices are those of an identical card as 'different' or a completely different one as 'same'. The latter error was made by only one child, in P (at 3 yrs 1 mo, the second youngest to be tested), and by her only once. She also chose an identical card as 'different', as did two other children in P and two in J1.

Justifications.

The children's justifications of their selections were categorised as similarities, differences, both and no responses as in Chapter 4. In a few cases a child did not respond verbally to the request for a justification, but simply pointed to pictures on the two cards. These cases are counted as similarities or differences depending on whether the birds pointed to were the same or different. The similarities and differences offered included references to the colour, shape and posture of the birds, as well as to the presence or absence of particular birds and general statements such as 'They have the same birds on' or 'Not the same birds'. These last kinds of statement were included as similarities or differences but assertions such as 'They are the same' or 'They are different' were, as for previous experiments, counted as no responses. This is because they could be an automatic response to the experimenter's request and say nothing about the selection made, whereas a reference to 'birds' is related to the selection.

Figure 6:5 shows the proportions of different categories of justifications offered by children in the different age groups. Justifications mentioning both similarity and difference are more common for 'different' selections than for 'same' ones, but 'no responses' are less common. Kruskal-Wallis analyses of variance show that the number of differences justifying 'different' selections increases with age ($H = 8.67$, d.f. = 3, $p < .05$, 42 Ss) but the number of similarities justifying 'same' selections does not increase to a statistically significant extent ($H = 6.06$, d.f. = 3, n.s., 42 Ss).

Overall, 79% of 'same' justifications and 76% of 'different' justifications are appropriate and the difference between them is not statistically significant (Wilcoxon matched-pairs signed-ranks test, $N = 24$, $T = 133$ n.s.).

In Chapter 4 the probabilities of individual subjects' justification performances being given by chance, given their selections, were calculated. One of the assumptions of this analysis was that justifications must consist of mentions of the properties involved in the experiment. In the present experiment the range of justifications

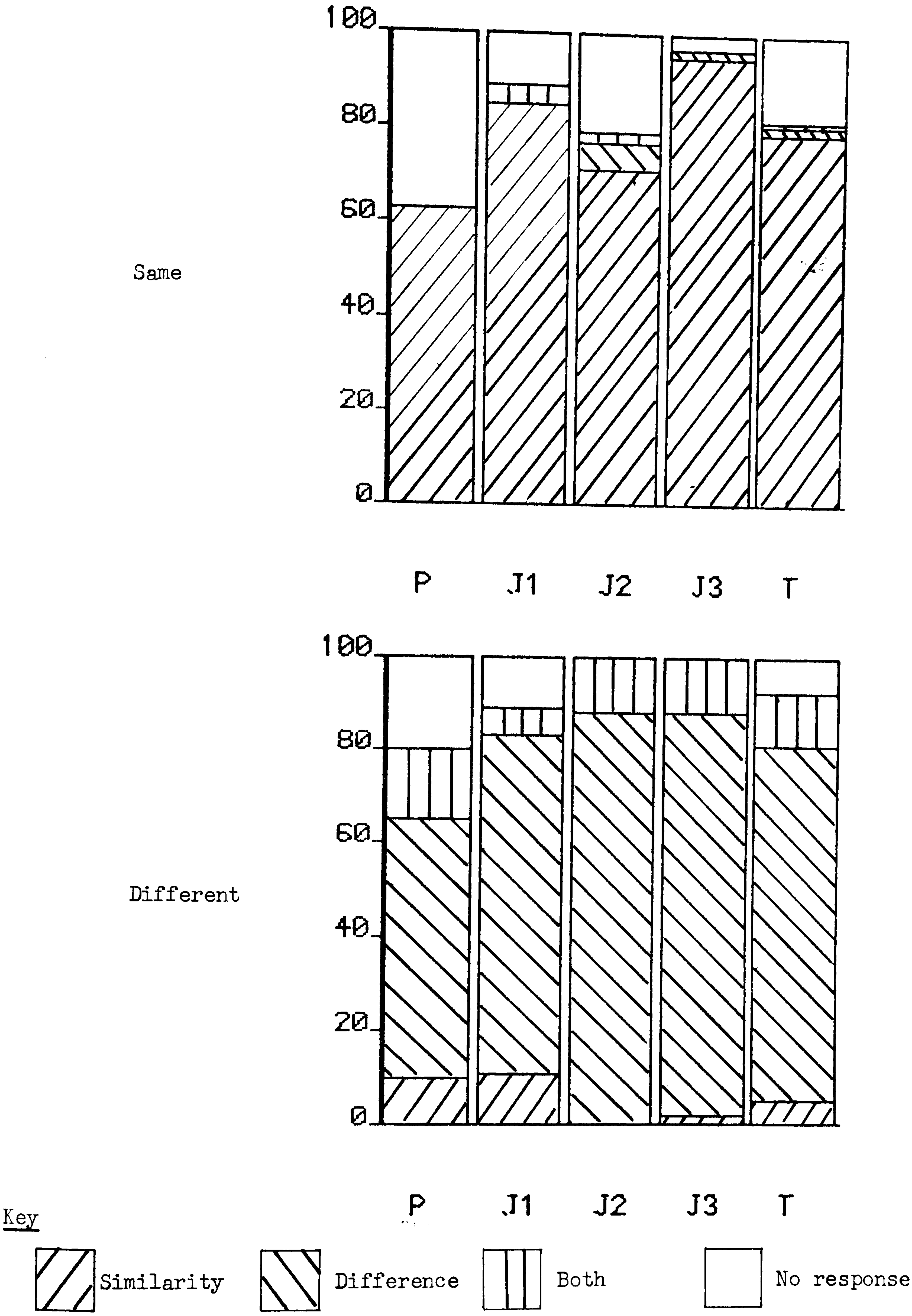


Figure 6:5. Percentages of justifications of different types.

offered was wide and such a procedure would be inappropriate. It can however be noted that since 'same' selections tended to be more similar to the target than 'different' selections were dissimilar from it, a child would be more likely to give an appropriate 'same' justification by chance than he would be to give an appropriate 'different' justification.

Two children, one in J2 and one in J3, gave differences in justification of 'same' selections while six children, four in P, one in J1 and one in J3 justified 'different' selections by similarities. The latter group includes the child who refused to make one 'different' selection.

One child made an unqualified assertion that two cards were different and he and three others made similar assertions that two cards were the same. The differences between 'same' and 'different' in this respect does not account for the total difference in the number of 'no responses'.

Interpretations of 'same' and 'different'.

A child is held to understand either of the terms 'same' and 'different' if he makes no absolutely wrong selections or justifications (i.e. a completely different card for a 'same' selection or an identical card for a 'different' one; a difference as a 'same' justification or a similarity as a 'different' one) for that term and if he either distinguishes between his 'same' and 'different' selections or gives at least five out of six appropriate justifications for the term in question. The numbers of children who understand the terms, as assessed by these criteria, are given in Table 6:9.

	Understand 'same'		Understand 'different'		Understand both		
	N	%	N	%	N	%	Total N
P	8	80	4	40	4	40	10
J1	8	89	6	67	6	67	9
J2	9	82	9	82	8	73	11
J3	10	91	9	82	8	73	11
Total	35	85	28	68	26	63	41

Table 6:9. Children who understand 'same' and 'different'.

The children who did not make all selections are excluded from Table 6:9. Of these, the child in P whose 'same' selections were complete did not satisfy the criteria for understanding that term while the child in J1 whose record for 'different' was complete did understand it.

Of the eight children who fail the criteria for understanding 'same', three, including the child with an incomplete record, appear on balance to understand it correctly. Four children have quite uninformative performances. The remaining child justifies four of his selections with differences (and two with similarities) but these differences are different from those he used to justify 'different' selections in that they refer to the absence of certain birds whereas the latter refer to differences in colour between the birds. Although his performance is odd, it does not seem to show a systematic misunderstanding of 'same'.

Of the fourteen children who fail the criteria for understanding 'different' seven seem to be interpreting it correctly most of the time, and one has a quite uninformative record. There remain six cases of possible systematic misunderstanding. These include the child whose 'different' record is not complete but since she made five 'different' selections there is quite a lot of evidence to go on.

Criteria for a child treating 'different' as if it meant 'same' corresponding to those for understanding the term correctly would be that the child would have to make no completely different selections or give any differences in justification, and at least five of the justifications would have to be similarities. No child meets these criteria. One child in J1 fails only because she makes a completely different choice (as well as an identical one). All her 'different' selections are justified by similarities, the completely different card being justified by saying that birds in corresponding positions on the two cards both have tails. The child with an incomplete record seems an even clearer case. All her five selections were of cards with four pictures in common with the target, making them slightly more similar to the target than her 'same' selections, on average. For the missing selection she selects three cards and then rejects them, saying 'not the same' as she rejects two of them. Three of her justifications are similarities and the other two are simple assertions that the two cards are the same. Such assertions - 'they are the same' and just 'same' do not have the same status in response to a question about difference as they do in response to 'How are they the same?' as they cannot simply be an echo of the experimenter.

The evidence concerning the remaining four children is not as strong, though on balance they seem to be treating 'different' as if it meant 'same'. One of these is the child who chose a completely different card as 'same'; she never makes such a selection as 'different' but chooses one identical card and her only justification which is not a 'no response' is a similarity. Her responses to 'same' and 'different' are in general very similar, but it is not clear that she understands either term. Another child,(KT), makes no wrong selections, and indeed chooses one completely different card, but justifies each of her selections by a similarity, an assertion that the two are the same, or a 'no response'. Another, also in P like the previous two, chooses two identical cards and no completely different ones and offers a mixture of similarities, differences and both in justification. The other child in this group is in J1. He chooses one identical card and two completely different ones, and his justifications are either differences or fall into the 'both' category. One justification counted as a difference is 'Because that bird isn't different to that bird', pointing to a cock sparrow and a robin. This seemed to be intended as a difference and he has either made a slip of the tongue or he is using 'different' with the meaning 'same'.

A fairly conservative position to adopt on the children's interpretations of 'different' would be to say that 29 children interpreted it correctly, 2 interpreted it as 'same' and no firm decision could be reached on the remaining 12 cases. The two 'same' cases represent 5% of the subjects, one school child representing 3% of the school groups. Even if the four doubtful cases were included, there would be only 14% of the whole group and 6% of the school children who seem to interpret 'different' as 'same'.

Cross-classifying the interpretations given to 'same' and 'different' yields Table 6:10.

		Interpretation of 'same'		
		Same	Other	
	Same	1	(1)	2
Interpretation of 'different'	Different	26	2 + (1)	29
	Other	8	4	12
		35	8	43

Figures in brackets represent subjects who did not make all selections.

Table 6:10. Cross-classification of interpretations given to 'same' and 'different'.

Interpretations of 'same' and 'different' by subjects participating in both experiments 1 and 2.

Subjects.

There were ten subjects, aged 3 yrs 0 months to 4 yrs 8 months, mean age 3 yrs 10 months (ages taken at time of experiment 2) who took part in both experiments 1 and 2. Other children who appear in the P groups for these experiments were unwilling or absent when wanted for the other experiment.

Procedure.

Experiment 2 was carried out with these subjects a few days after experiment 1.

Results.

Although it is interpretations of 'different' that are of the most interest, the position with 'same' can also be considered. Cross-classification of the results of the two experiments gives the following picture for 'same' interpretations:

Category for expt. 2:	Category for expt. 1: Same	Other	
Same	7	0	7
Other	2	1	3
	9	1	10

Table 6:11. Interpretations of 'same' in experiments 1 and 2.

The criterion used in experiment 2 seems to have been stricter than that used in experiment 1. The one case to be classified as 'other' in the first experiment is also so classified in the second.

The cross classification for 'different' is given in Table 6:12.

Category for expt. 2	Category for expt. 1: Same	Different	Other	
Same	1	0	0	1
Different	0	4	0	4
Other	1	3	1	5
	2	7	1	10

Table 6:12. Interpretations of 'different' in experiments 1 and 2.

There are no clear instances of a child treating 'different' as 'same' in one experiment and as 'different' in the other. The one clear case of a child treating 'different' as 'same' found in this group in the second experiment was one of the four cases found in the first. Of the other three cases found in the first experiment two did not take part in the second one and one was classified as 'other' although it was thought likely that she was treating 'different' as 'same'. This was the child who did not show clear understanding of 'same' or 'different' in that experiment.

There were two other children in P who, although not clear cases, seemed on balance to be interpreting 'different' as 'same' in experiment 2. One of these did not participate in experiment 1, the other was classified as understanding 'different' then, and therefore comes closest of all the subjects to completely changing her interpretation from one experiment to the other.

This subject is the one referred to as KT, and her performance will be summarised here. In the first experiment she declared all pairs to be the same in the 'same' condition and although her 'different' judgements suggested correct understanding she made some odd remarks to the effect that one member of a pair was the same, or different, while the other was not. In the second experiment she never made a completely wrong choice and made a choice of the appropriate extreme once in each condition (an identical card as 'same' and a completely different one as 'different'). Most of her justifications were no responses, the others were similarities, one for a 'same' selection and the other three for 'different' selections. The overall picture is one of confusion. The child's general manner in testing was one of willingness to carry out the task but unwillingness to devote a great deal of attention to it. She may be interpreting 'different' as 'different' on one occasion and as 'same' on the other but one would not wish to push this claim strongly.

It is not surprising that no clear instances of variation from one experiment to the other have beenfound, as there were only ten subjects in all and only two of these clearly adopted the 'same' interpretation in either experiment.

Discussion.

A principal point of interest for this chapter is the proportion of subjects who appear to be treating 'different' as if it meant 'same' in the different experiments. These proportions are summarised in Table 6:13.

	Pre-schoolers		School children	
	No.	% of group	No.	% of group
Chapter 4, selection task	4	16	1	2
Chapter 5, judgement task, open condition	-	-	17	20
Chapter 5, judgement task, closed condition	-	-	8	9
This chapter, 1st experiment, judgement task	4	31	3	9
This chapter, 2nd experiment, selection task	1	9	1	3

Table 6:13. Numbers and percentages of children who treat 'different' as if it means 'same'.

These figures seem to support the claim that the high proportion of this error found in the previous chapter was due to the task used, as the judgement task in the present chapter results in more systematic misunderstanding than the selection task, although the rate of error is only as high as found in the closed condition in Chapter 5 while the procedure corresponds to the open condition.

However the position is not as clear-cut as this. None of the children consigned to the 'other' category for their use of 'different' in this chapter's first experiment seemed more likely to be interpreting 'different' as 'same' than as 'different', although two were equally balanced, while four 'other' cases in the second experiment did seem closer to an interpretation as 'same' than as 'different'. If these subjects were included in the figures given above, those figures would rise to 4, or 36%, for pre-school children and 2, or 6%, for school children. Such a practice would be rather lax, but this does serve to illustrate the problem that the percentages obtained are in part a result of the criteria used and in most cases there is a degree of arbitrariness in setting the criteria. On balance the writer would still argue that systematic misunderstanding was higher in the judgement task than in the selection task, but with less certainty than the figures in the above table would seem to warrant.

Two further comments about these figures can be made before proceeding to the next point. The first is that, except in the experiment reported in the previous chapter, the absolute number of subjects who make the error is very low, especially among the school children, and so the percentages must be unreliable. The second is a reminder that the figures drawn from Chapter 4 are based only on those subjects who completed the task, who made up 66% of the pre-schoolers and 91% of the school children. It is not unreasonable to suggest that the children who did not complete the task were in general poorer performers and would be more likely to show misunderstanding of 'different' than the other subjects. If this is so, the figures, particularly for pre-schoolers, are underestimates.

The second main aim of this chapter was to see if any subjects could be found who showed correct understanding of 'different' in one experiment but treated it as if it meant 'same' in the other, thus replicating Chapter 5's finding that some subjects used the incorrect interpretation in either the open or closed condition but the correct interpretation in the other condition. It may have been over-optimistic to expect such a finding with only ten subjects taking part in both experiments and there were no clear cases. There was however one subject who seemed to understand the term correctly in the first experiment and was classified as 'other' for 'different' in the second experiment, though her behaviour seemed closer to an interpretation as 'same' than as 'different'. Her performance as a whole suggested a degree of confusion about both the terms 'same' and 'different' and it may be that she opted sometimes for one and sometimes for the other interpretation of 'different' possibly even within the course of a testing session.

A number of other findings of the previous experiments were replicated in the experiments reported in this chapter, some more completely than others.

First, and perhaps least interestingly, the effects of age. The selection task reported in Chapter 4 showed a mixture of significant and non-significant changes with age in the number of properties common to selection and target while the current experiment found no statistically significant changes, though the results come close to significance. In both experiments only one wholly incorrect 'same' selection was made, by one of the youngest subjects in both cases. More incorrect 'different' selections were made and these declined with age in both experiments. Chapter 5 reported a statistically significant difference due to age in the number of correct judgements while this chapter did not, though there was reason to accept that there was a genuine difference with age in the number of correct 'different' judgements. Both the correct interpretations 'all same' and 'all different' were found to increase with age in Chapter 5; only 'all different' did so in the present chapter.

Some differences between responses to 'same' and 'different' instructions were found in all experiments. In both selection experiments 'same' selections were significantly more similar to the target than 'different' ones, but both 'same' and 'different' selections were more similar to the target in Chapter 4's experiment than in the present one. In the former case, cards as similar as possible to the target were chosen on over 80% of occasions compared to less than 50% of occasions for the later experiment. 'Different' selections were more similar to the target than random selections from the cards in the former case but not in the latter. Chapter 4 reported that children in the middle of the age range made 'different' selections that were more dissimilar from the target than those made by either older or younger children; this was not replicated in the present chapter.

The one point at which differences between the responses to 'same' and 'different' instructions seem to be lacking is in the number of appropriate justifications, which seemed to be much the same for both 'same' and 'different' selections, in both of the experiments under consideration. However it was shown in Chapter 4 that performance in 'different' justifications could be considered to be better than for 'same' justifications because the likelihood of an appropriate justification being given by chance was much lower for 'different' than for 'same' selections. The same is true of the present experiment, though to a lesser extent because of the changed nature of the selections, mentioned above. Although the numbers of appropriate justifications are about the same for both 'same' and 'different' selections the proportions of other kinds of justification vary. In both experiments there were more similarities justifying 'different' selections than differences justifying 'same' selections, and more 'both' justifications for 'different' selections while 'no responses' were more common when justification of a 'same' selection was requested. There were also more unqualified assertions that two cards were the same than that they were different.

The number of correct responses was significantly greater for 'same' judgements than for 'different' judgements in both judgement experiments. There are two reasons for this: interpretation of 'different' as if it meant 'same' (the results concerning which have been discussed in some detail above) while only one child in one condition in one experiment seemed to treat 'same' as if it meant 'different', and the greater prevalence of the 'any different' interpretation of 'different' compared to the 'any same' interpretation of 'same'. A consequence of these incorrect interpretations is that in both experiments more age groups show statistically significant differences in the number of correct responses between different types of 'same' problem than between different types of 'different' problem. As mentioned, the 'any different' interpretation was more common than the 'any same' one in both experiments but the absolute frequencies varied, as Table 6:14 shows.

	Percentages of subjects who interpreted:			
	'same' as:		'different' as:	
	All same	Any same	All different	Any different
Chapter 5	22%	8%	11%	15%
This chapter, school children	69%	6%	25%	38%

Table 6:14. Interpretations of 'same' and 'different' in judgement experiments.

There are lower proportions of 'all same' and 'any same', and of 'all different' and 'any different' combined in the results from Chapter 5 because there were more cases where it was not possible to decide between the two interpretations in that experiment. However the startling feature about the relative proportions of the 'all' and 'any' interpretations is the great increase in the correct 'all same' interpretation found in the experiment reported in this chapter. The relative proportions for 'different' interpretations are not very different from those found previously.

In Chapter 4 an argument was put forward suggesting that the children's performance may have been the result of them sometimes perceiving the stimuli in a separable fashion and sometimes in an integral fashion, in the terms of Garner (1970). If this is so some differences in results in the experiments reported in the present chapter from those found previously would be expected, because of the different stimulus materials used. The cards used in Chapter 5 and in the second experiment of the present chapter must facilitate separable perception, consisting as they do of a number of separate pictures, those pictures not requiring further analysis, while the geometric figures used in the other experiments could well be perceived integrally.

The differences reported above will now be discussed in the light of this argument.

The degree of similarity between two objects perceived integrally is something which is immediately perceptually experienced while if two objects are separably perceived their degree of similarity may be something which is partly worked out cognitively - reckoning up the points of similarity and those of difference. This is in line with

Wohlwill's (1968b) comments about the differences between perception and cognition. The experience of identity is a special case. Even for an adult, that is, for the writer, a pair of identical geometric figure cards stands out strongly while there is not this effect for a pair of identical cards from either of the other two sets of materials. For a child who perceives the geometric figures in an integral fashion this contrast must be greater.

On this account it is easy to see why 'same' selections are more similar to the target when the stimuli are geometric figures than when they are sets of pictures. In the former case the task is performed perceptually and the closest match is easy to pick out. (The closest match is not always chosen: in some cases it may be the most similar card within a narrow field of view that is chosen, in other cases it may be that the child has not got the target in view or a clear image of it in his mind. A child who does not perceive these figures integrally may also sometimes pick a less similar card.) In the latter case assessing similarity is a much slower process and it is not surprising if the children often settle on a card which, they have established, has some pictures in common with the target before completing the comparisons and so often pick cards which are not identical.

As for 'different' selections, it was argued in Chapter 4 that being asked for a difference may tend to switch some children, at least, into a separable mode of functioning. If the children find separable perception of the geometric figures difficult, it may be that only one or perhaps two of the dimensions are perceived separably, the others remaining integral with each other. A child in this position may then look for a card which is different in that one, or those two, respects only. A child performing the selection task in this chapter, with the cards of birds perceived separably, would function in much the same way for 'different' selections as for 'same' selections. This accounts for 'different' selections being more similar to the target in the former experiment than in the latter one, but it does not explain why in the later experiment 'same' selections should be more different from chance than 'different' selections. The explanation for this is indicated by the results of the judgement experiments. When instructed to use 'all same' and 'all different' interpretations of the terms subject favoured 'all same' over 'any same' but 'any different' over 'all different'. If they show the same tendency when not given any explicit instructions, as it seems intuitively very likely they would, the results in question are accounted for.

It was argued in Chapter 4 that separable perception, and consequent selection partly by cognitive means, should facilitate appropriate justification, because the basis of selection, having been in awareness, should remain available for justification purposes. This would lead one to predict improved justification performance in the experiment reported in this chapter over the previous one, particularly for 'same' selections. On the other hand, because of the differences in the nature of the selections, appropriate 'same' justifications would be more likely by chance in the previous experiment, but appropriate 'different' justifications would be more likely in this experiment. In fact there were higher proportions of appropriate justifications for both 'same' and 'different' selections in the present experiment than in the earlier one, although the differences are not very great. In Chapter 4, 72% of 'same' selections were justified by similarities and 71% of 'different' selections by differences. In the present case the corresponding figures are 79% and 76% respectively. There are more dramatic differences in the proportions of the other kinds of justifications, especially for 'same' selections. 'No responses' are more common among the justifications recorded in the present experiment while for 'same' selections differences and 'both' cases combined have dropped from 18% of the total to 3%, and for 'different' selections the numbers of similarities and 'both' cases combined have dropped from 22% to 16%. The drop in inappropriate similarities and differences and in 'both' cases would be expected on the proposed account; the increase in the number of 'no responses' would not be expected.

The difference in stimulus materials can also account for the increased prevalence of the 'all same' interpretation of 'same' evidenced in the judgement experiments. With the geometric figures, judgement has only to follow perceptual experience which, as has already been stated, is quite different for identical pairs and for pairs of cards that are not the same in all respects. In the experiment reported in Chapter 5 not only is there no great perceptual difference between identical pairs and others but checking whether or not a pair of cards have all pictures in common takes some time, so it is not very surprising if many subjects opted for interpretations such as 'any same' which required less work on their part. For 'different' selections an interpretation as 'any different' is logically just the reverse of 'all same' but it may not be recognised as such by the subjects. Those using this interpretation may instantly reject identical pairs, but check further on all other pairs to establish that there is a difference between them. Use of the 'all different' interpretation would always require further work after any rejection of the identical pairs. Such an explanation is necessary to account for the fact that the 'any different' interpretation is only slightly more popular, relative to the 'all different' one, in the present experiment than in the previous experiment.

Differences in the number of correct judgements between different types of problem were predicted in the judgement experiments on the basis of the likelihood of a correct judgement being made when not all the information available (pictures or properties) was taken into consideration. There would be no difference between identical and completely different pairs in the experiment reported in this chapter, on this basis. However, the argument given above would predict that identical pairs would be easier, at least for 'different' judgements as the identical pairs can be rejected perceptually while the judgement of completely different pairs requires cognitive processing which is more vulnerable to error. Whether or not any difference would arise with 'same' judgements depends on whether all non-identical pairs are rejected automatically or whether some further scrutiny is made before accepting or rejecting them. In practice, two children found identical pairs easier than completely different ones and three children found the reverse for 'same' judgements, while eleven children found the identical pairs easier and only one the completely different pairs for 'different' judgements. Performance on 'same' judgements was so high, with all but five of the subjects scoring 100% on the pairs under consideration that the position with them is best regarded as inconclusive. For 'different' judgements however, identical pairs do seem to be easier.

Finally, the influence of the properties, colour, shape and pattern in the judgement experiment described in this chapter will be considered.

In this experiment, if two geometric figures were the same shape they were very likely to be regarded as the same or not different but they were much less likely to be so regarded if they were the same colour, with pattern being intermediate. This is supported by the children's spontaneous remarks, several of them saying, effectively, 'These are the same things, although they're different colours' while such comments were volunteered by only one child for each of shape and pattern. When the same geometric figures were used in the experiment reported in Chapter 4 the children showed a strong tendency to pick figures of the same shape regardless of whether they were selecting ones that were the same or different, while it was pattern that was most likely to be used as the vehicle of similarity and difference: that is, 'same' choices tended to be the same pattern and 'different' choices a different pattern from the target. Pattern was also the property most often cited in justification, followed by shape.

It may be that the children regard shape as defining what an object really is, with colour and pattern being incidental. This is surely true of adults also - we think that a blue and white striped teapot is a teapot which happens to have blue and white stripes, not a blue and white striped object that is teapot-shaped. This seems a reasonable way of looking at things because the importance of objects lies in their function and among superficial physical characteristics shape is the best indicator of function. The children's selections of figures of the same shape as 'different' may indicate that their preferred exemplar of something different is a different object of the same type, not an object of a different type.

It is not clear why the children should react differently to colour and pattern. It may be that pattern differs from colour because in the physical world few things, other than clothes and furnishings, are regularly patterned so that the children are more used to differences in colour, and to regarding them as irrelevant, than they are to variations in pattern. (Texture and irregular colour variation are of course important in the physical world but regular pattern is often made by arrangements of things, such as bricks in a wall, rather than being a property of the things themselves.)

Colour appeared to be of more importance in the experiments reported in the previous section, where it was often mentioned in the children's answers. Two reasons suggest themselves for this; firstly, just because colour is typically an inessential characteristic and varies even among objects designated by the same name it can be manipulated by the child: he can say that an orange and a butterfly are the same colour because of the variety of colours in which butterflies come. Secondly, individual objects are generally seen as having a single overall shape and size, though of course they are composed of parts of different shapes and sizes and the children occasionally made use of this, but they are of several colours. Thus a daisy can be the same colour as a buttercup (yellow centre, petals), a bluebell (green stems), a tree (green stem, leaves) and a mushroom (white petals, cap).

Finally, it should be noted that those results of the experiments using the geometric figures relating to the properties of colour, shape and pattern may be due to the particular colours, shapes and patterns used and may not be freely generalisable to other instances.

Section III. The meaning of 'different'.

Chapter 7. Does 'different' ever mean 'same'?

A persistent finding reported in this work is that some children treat the word 'different' as if it means 'same', a result first found by Donaldson and Wales (1970). Donaldson and Wales report other similar findings by their research group, of which the one which has had the greatest impact is that most three year olds treat the word 'less' as if it means 'more', the outcome of an experiment fully described by Donaldson and Balfour (1968). Other writers have suggested that children might behave as they do in Donaldson and Balfour's experiment - for instance, might pick out from a pair of apple trees the one with the greater number of apples when asked 'Which tree has less apples?' - without actually being under the misapprehension that 'less' means 'more'. Clark (1970) proposes a partial lexical entry hypothesis: that the children knew that 'less' refers to quantity and because of a response bias they picked the greater quantity (possibly, Clark suggests, because a large quantity is a better exemplar of quantity than a small one). Carey (1978a) reports two experiments to test such a hypothesis - that the results are a consequence of an incorrect or incomplete lexical entry combined with a response bias - against an alternative hypothesis that the word 'less' plays no part at all, the response being determined by the sentence frame and the non-linguistic context. Carey found that almost all children who treated 'less' as if it meant 'more' responded in the same way to a nonsense syllable, thus supporting the latter hypothesis.

If the children who responded to 'less' as if it meant 'more' were treating the word no differently from a nonsense word, the same could be true of children who respond to 'different' as if it means 'same'. This chapter reports an experiment to test these two hypotheses, that the children making this particular error have an incorrect lexical entry for 'different' and that they have no lexical entry for it at all, by comparing their responses to 'different' with those to a nonsense word.

In the course of earlier experiments reported in this work the writer noted some spontaneous remarks made by the subjects in which they themselves used the word 'different' as if it meant 'same'. When the experimenter was demonstrating the examples for Chapter 5 and said of two cards that they were different (they had no two pictures in common) one child objected 'But they're not different'. It has already been reported in Chapter 6 that one subject said of two identical geometric figures 'That one's a square and that one's a square, they are different' and of two different figures 'Those aren't different, that one's a square and that one's a ball', and that in the bird matching experiment a child commented of a robin and a cock sparrow 'That bird isn't different to that bird'. These remarks suggest that for those children at least, 'different' really does mean 'same'. It is possible to respond to an instruction containing a term without assigning any meaning to that term, but to use a word himself a speaker must assign some meaning to it and there is no compulsion on these children to use 'different' if they are uncertain about it.

This evidence that some children have a lexical entry for 'different' more appropriate to 'same' does not rule out the possibility that others respond to the term in like manner although they have no lexical entry for it whatever. All the experiments so far reported clearly involved comparisons of some sort and the use of the probably known word 'same' may have encouraged some subjects to attribute the same meaning to 'different', or indeed to respond to 'different' correctly without actually knowing the meaning of the word, simply by realising that comparisons of difference as well as of similarity were possible in the situation. In the experiment to be described in this chapter the children are asked to pick out objects which are the same, different, red, and 'prebble' (the nonsense word used). 'Red' is included, following a suggestion by Robin Campbell, so that any tendency to treat an unknown word as having the same or a related meaning to a known word will not necessarily lead the children to assign the meanings 'same' or 'different' to 'prebble'. Children in this age group may not fully understand 'red' but they are likely to know that it is a colour term (Bartlett 1977). To the same end, those of the critical objects (items of clothing) which are not red are what the writer would describe as kingfisher green, that is, an unfamiliar and non-prototypical shade, so that a possible referent for an unknown word is clearly available, especially for children pursuing an 'odd colour - odd word' strategy, as found by Carey (1978b). These precautions should reduce the likelihood that both 'different' and 'prebble' are treated as if they mean 'same', but for different reasons: 'different' because of an incorrect lexical entry and 'prebble' because of response bias.

It is hypothesised that some evidence of genuine misinterpretation of 'different' as meaning 'same' will be found, though systematic responding to the nonsense word is also a possibility.

Method.

Subjects.

The subjects were 31 children drawn from two playgroups, one run by the Students' Association in the university, mainly for students' children but with some children of members of staff also attending, and the other in the local community, catering largely for middle class children. (This latter group has been described in connection with other experiments, but the subjects participating in the present experiment had not previously been employed in others.) The age range of the subjects was 2 years 9 months to 4 years 1 month and the mean age was 3 years 6 months.

Materials.

The materials consisted of six coloured cut-out cardboard figures of boys and girls, approximately 19-21 cm. in height. The figures were dressed in outdoor clothing, each wearing a coat or jacket with both pockets and buttons, gloves and shoes. Two colours only, pillarbox red and kingfisher green, were used for these four critical items of clothing, as shown in Table 7:1.

Figure no:	1	2	3	4	5	6
Shoes	Green	Both	Both	Both	Red	Green
Gloves	Both	Red	Both	Green	Both	Red
Pockets	Green	Green	Green	Both	Both	Both
Buttons	Both	Both	Red	Red	Red	Both

Table 7:1. Colours of critical items of clothing.

If all pieces of a particular critical item of clothing on a figure were of the same colour - if both gloves were red, or all buttons were green, for example - that item was termed the 'same' while if both colours were used the item was termed 'different'. An individual shoe, glove, pocket or button was always of one colour only. It can be seen that each figure has two items of clothing which are the same and two which are different, and each item of clothing is the same on three figures and different on the other three.

Procedure.

Each child was tested individually, seated beside the experimenter at a table in a room close to his or her playroom. The six figures were laid out on a table in front of the subject who was encouraged to talk about them. At this stage the experimenter asked each child if there was anything funny about the figures. This was a largely unsuccessful attempt to elicit remarks about the non-matching items of clothing. The child was then asked 'Can you show me one whose shoes (gloves, pockets, buttons) are the same (different, red, prebble)? This form of question was repeated for all sixteen possible combinations of item of clothing and critical term, the questions being asked in a different pre-determined random order for each child. The experimenter noted down the child's selections. Following Carey's (1978a) procedure, a child who questioned the meaning of 'prebble' was told that it meant 'different'. The sessions were tape-recorded so that any remarks made by the children which were relevant to the task could later be transcribed.

Results.

Only one child, aged 3:11, asked what 'prebble' meant and was consequently told that it meant 'different'.

Refusals to respond.

A number of children refused to respond to some instructions. Table 7:2 shows the number of subjects who failed to respond to each critical term a particular number of times.

No. of refusals:	None	1	2	3	4
Same	23	4	3	1	0
Different	28	1	0	2	0
Prebble	19	3	4	3	2
Red	23	6	0	2	0

Table 7:2. No. of subjects refusing to respond.

Wilcoxon matched-pairs signed-ranks tests comparing the number of refusals to respond to each term with those for each other term give the results shown in Table 7:3.

	N	T	p(2-tailed)
Same - different	6	2.5	n.s.
Same - prebble	11	10.5	$< .05$
Same - red	7	12	n.s.
Different - prebble	11	2.5	$< .01$
Different - red	7	4	n.s.
Prebble - red	15	22	$< .05$

Table 7:3. Results of statistical tests on refusals to respond.

There were significantly more refusals to respond to instructions involving 'prebble' than to any of the other terms, while the other terms do not differ significantly from each other in this respect. 1-tailed tests would have been appropriate for comparisons involving 'prebble' (and would not have made any difference to the significance levels obtained) but the results of 2-tailed tests are given so that all comparisons are made on the same basis.

Although 'prebble' elicited more refusals than any of the real words, 18 subjects, or 58% of the total, were not given a meaning for it but still responded to all four instructions including the word.

Distribution of responses over 'same' and 'different' items.

Most subjects picked out more than one of the figures in response to each question. Taking all responses to all four instructions per term into account, Figure 7:1 shows the numbers of subjects who chose different proportions of 'same' items in response to the instructions involving 'same', 'different' and 'prebble'. Two subjects who made no responses to 'prebble' are omitted from Figure 7:1:c. Overall the pattern of response is rather poor. It might have been expected that most subjects would have selected all, or almost all, 'same' items in response to 'same' instructions but only a minority do so. Responses to both 'different' and 'prebble', especially the latter, are bunched around a level suggesting random responding. The subjects at the bottom end of the distribution for 'prebble' include the child who was told that 'prebble' meant 'different', and responded appropriately. In total the children chose 'same' items 68% of the time in response to 'same' instructions, on 46% of occasions for 'different' instructions and 43% of occasions for 'prebble' instructions.

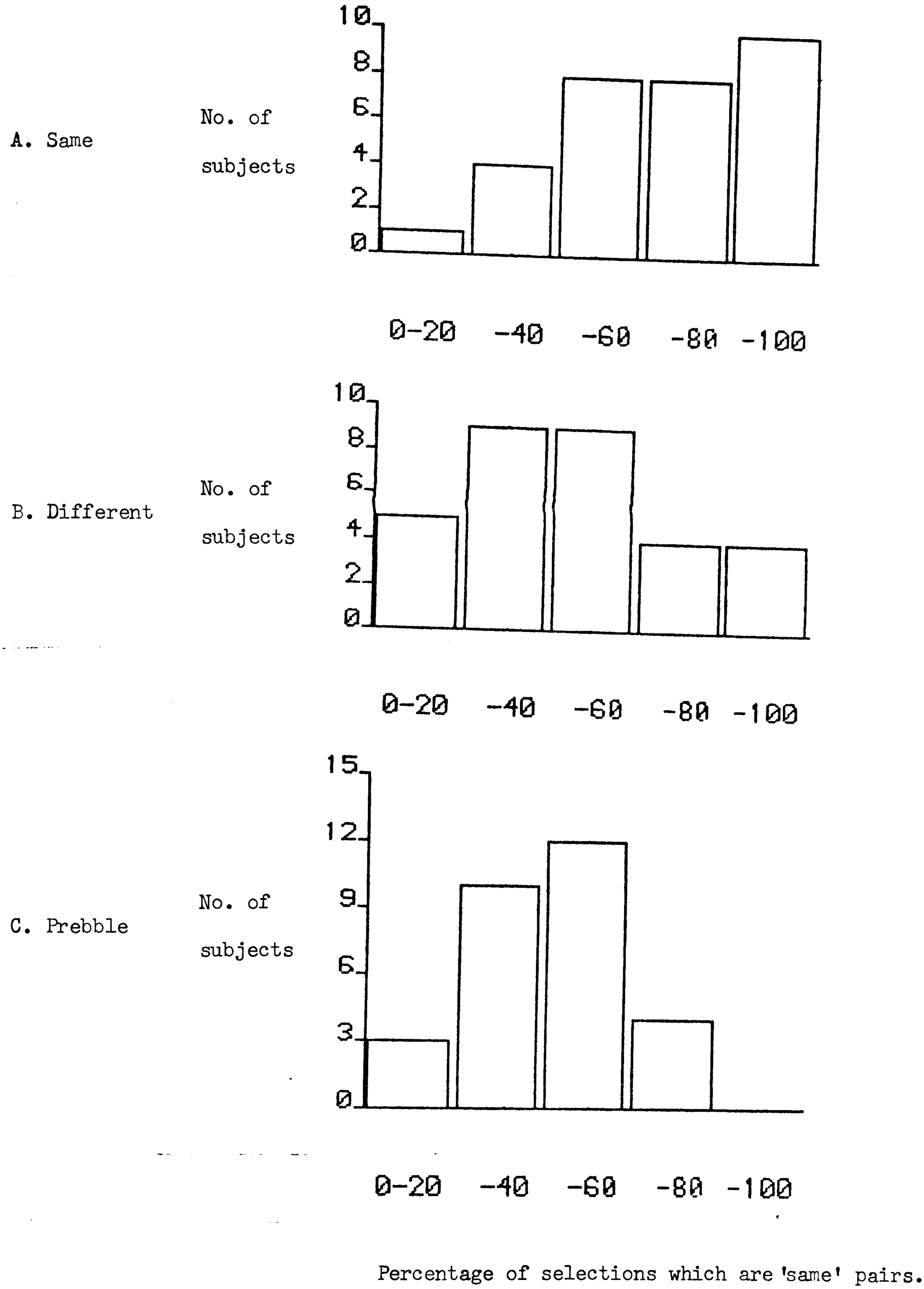


Figure 7:1. Numbers of subjects making different percentages of 'same' selections.

The overall distribution of responses, rather than just the numbers of 'same' and 'different' items chosen, is important. Although Figure 7:1 suggests that it is not so, it could be the case that there was no tendency to pick either 'same' or 'different' items in particular in response to 'different' and 'prebble' for different reasons for the two terms: some subjects could pick all 'same' items and some all 'different' ones in response to 'different', while all might pick a mixture for 'prebble'. Kolmogorov-Smirnov 1-sample tests were carried out on the distributions shown in Figure 7:1, using the same intervals, to determine whether those distributions were significantly different from chance. Only that for 'same' was found to be so ('same' $D = 0.31$ $p < .01$, 2-tailed; 'different' $D = 0.10$ n.s., 'prebble' $D = 0.16$ n.s.). (As the children contributed various numbers of responses to these distributions the theoretical distributions were worked out by calculating the distribution for a child making each particular number of responses and then summing these appropriately for each instruction.)

Although the distributions for neither 'different' nor 'prebble' are significantly different from chance they might still differ from each other. If they did so simply because some subjects responded correctly to 'different' this would be uninteresting, but the likely presence of some such subjects makes testing any possible difference difficult. It was decided to test it by determining whether the children show more extreme patterns of response (that is, tend to make selections of one kind only - 'same' or 'different' items) for 'different' than for 'prebble' instructions. The critical subjects are those who tend to choose 'same' items in response to 'different' instructions. For those 16 subjects who chose 50% or more 'same' items in response to 'different' instructions the probability of their obtaining a pattern of response as extreme as their actual one was calculated for both 'different' and 'prebble' responses. A Wilcoxon matched-pairs signed-ranks test was then carried out on these probabilities and showed that the responses to 'different' were significantly less likely than those to 'prebble': $N = 15$, $T = 26$, $Z = 1.93$, $p < .05$, 1-tailed. These children therefore have a greater tendency to apparently interpret 'different' as 'same' than they have to interpret 'prebble' as either 'same' or 'different'.

It might be thought that some bias could arise if these particular 16 children were peculiar in their 'prebble' response patterns. The same procedure was carried out for the remaining 15 subjects, who chose more than 50% 'different' items in response to 'different' instructions. The chance probabilities of these subjects' response patterns were also significantly lower for 'different' responses than for 'prebble' ones, (Wilcoxon matched-pairs signed-ranks test, $N = 14$, $T = 25$, $Z = 1.73$, $p < .05$, 1-tailed). So regardless of whether the children tended to choose 'same' or 'different' items as 'different', they were more likely to choose items of one kind only than they were in response to 'prebble' instructions.

Interpretations of the terms.

It is obvious from Figure 7:1 that extreme response patterns are few, and it has been shown that they are too few for the distributions for 'different' and 'prebble' to be significantly different from chance. Of those children who made at least four selections for the term in question, only six chose 100% 'same' items for 'same', four chose 100% 'different' and one 100% 'same' items for 'different' and none chose

100% items of one type for 'prebble'. Some criterion for saying that a child is attributing a particular meaning to a term must be adopted. The criterion chosen is that the probability of the child's actual response pattern for a term being obtained by chance is less than .1. Thus if a child makes only four selections in response to 'same' instructions all four must be of 'same' items for him to count as understanding 'same' but if he makes eight selections then seven of them being of 'same' items is sufficient. The numbers of subjects interpreting the various terms as either 'same' or 'different' by this criterion are given in Table 7:4.

	Term:	Same	Different	Prebble
Interpretation:	Same	11	4	0
	Different	0	5	2

Table 7:4. Numbers of subjects who interpret the critical terms as 'same' or 'different'.

One of the two 'prebble' cases is the child who was told that 'prebble' meant 'different'. The numbers involved are still small - too small for the difference between 'different' and 'prebble' in interpretation as 'same' to be statistically significant, though it is clearly in the expected direction. Fifteen children contribute to the above figures and their patterns of response for all three terms are given in Table 7:5.

Interpretation of			No. of	
Same	Different	Prebble	subjects	
S	D	D	1	
S	D	X	3	
X	D	X	1	
S	S	X	1	
X	S	X	3	
S	X	X	5	
S	X	D	1	
			15	

Key

S: interprets as meaning 'same'

D: interprets as meaning 'different'

X: neither of the above.

Table 7:5. Patterns of response of individual subjects.

The child who produces the S D D pattern is the one who was told that 'prebble' meant 'different'. This and S D X are the patterns to be expected from the best performers - correct interpretations for 'same' and 'different' but no interpretation ascribed to a nonsense word. X D X is similar, but odd in that one might expect a child who understood 'different' to understand 'same' also. S S X and X S X are the corresponding patterns to be expected from children who really do think that 'different' means 'same' and do not ascribe such a meaning to a nonsense word. It is worth noting that there are three cases of X S X to only one of S S X. The single most common pattern, contributed by five subjects, is S X X, indicating children who understand 'same' but have no lexical entry or strong response bias for either of the other terms. Finally, one child shows the pattern S X D, and this is the only case to support the notion that response bias may give the impression of a meaning assigned to one of the terms when the child has in fact no lexical entry for that term.

Responses to 'red'.

The overall performance of the children as so far reported is so poor that it seems worthwhile to consider the results for 'red' to see whether they are similarly bad. 'Red' of course differs from 'same' and 'different' in that the probability of a selection being right by chance is different - 25% if all red items only are considered, or 75% if both red and 'different' items are included. Only one subject picked out 100% all red items, refusing to make a selection in response to the 'red pockets' instruction since the pockets are always either all green or mixed. This was the same child who questioned the meaning of 'prebble'. However, the other children were not entirely indifferent to the merits of all red items as the selections overall consisted of 43% red items, 47% 'different' and 9% green items. Also, all six children who refused to respond to just one 'red' instruction did so on 'red pockets' but with the exception already mentioned all of them had previously picked a 'different' item in response to another 'red' question.

'Different' items are considered a correct response to 'red' instructions but even with this lax criterion only 16 children made 100% correct selections. Because the chance level of success for 'red' is so high, no child who fails to score 100% correct satisfies the .1 criterion used for 'same', 'different' and 'prebble'. It is likely that some of the others do understand the term, despite their errors, as their responses are not evenly distributed about chance level. Ten subjects score between 75 and 100%, one scores exactly 75% and four less than 75%. There is no firm evidence of any child treating 'red' as meaning green. Three children chose no red items in response to 'red' instructions; one of these made only one selection (green), another only two selections (both green) and the third chose 'different' items for all six of her selections.

The overlap between the 16 children who made 100% correct selections for 'red' and the 15 who showed a consistent interpretation for 'same' or 'different' is considerable, 12 subjects appearing in both groups. This point will be taken up in the discussion.

Discussion.

The children's performance in this experiment was really quite strikingly poor and the reasons for this must first be discussed.

The children were very young, having a mean age of 3 years 6 months, and five of the 31 subjects were two year-olds. The older subjects in the group performed better than the younger ones but the difference is not very marked: the 19 subjects who were classified as showing understanding of at least one of the terms 'same', 'different' and 'red' had an age range of 2 years 10 months to 4 years 1 month and a mean age of 3 years 7 months, while the remaining 12 subjects had an age range of 2 years 9 months to 4 years and a mean age of 3 years 4 months.

The subject population was not particularly different from those used in previous experiments: one of the playgroups utilised in the present experiment had been used before, though the participating subjects were different individuals, and while the university students' playgroup had not previously been employed there seemed to be no difference in performance between subjects from the two groups.

Any attempt to explain the poor results on the basis of the make-up (including age) of the subject population could in any case be only partially successful, as it remains necessary to show what it is about the task set which causes such difficulty.

It could simply be the critical terms used. A starting point for this chapter is of course that many children in the age group in question do not understand 'different'. In previous experiments almost all children seemed to understand 'same' but it could be that for some subjects, especially the younger ones, their understanding was only partial, aided by cues from the stimulus arrays used in those experiments.

However this experiment also found apparent understanding of 'red' to be lower than expected, and that it tended to be the same subjects who showed understanding of 'red' as of 'same' and 'different'. (Those subjects who interpreted 'different' as meaning 'same' are here considered to be showing a partial understanding of the term.) This suggests either considerable uniformity in vocabulary development or that it is not the terms themselves that are at the root of the problem.

If it is not these terms taken in isolation which cause the difficulty, it could be the whole construction in which they are used e.g. 'Can you show me one whose shoes are the same?' This instruction is clearly ambiguous: whose shoes are the same as what? The child is required to supply the interpretation 'same as each other' for himself. It was because it was realised that this might be a difficulty that an attempt was made to draw the children's attention to the similarities and differences in the items of clothing in the course of introducing them to the task. This had to be done fairly unobtrusively so as not to bias them towards interpreting 'prebble' as 'same' or 'different'. The ambiguous form of the question with 'same' and 'different' is of course a necessary consequence of using the same form with 'red' as with 'same' and 'different' and keeping the possible interpretations of 'prebble' open. The instruction with 'red' is not ambiguous but performance here, though better than with 'same', was still very poor. Difficulty in understanding the instructions does not therefore seem to be a likely explanation for more than a small part of the results.

It may be that the problem lies in the stimulus materials. This experiment used complex pictorial stimuli from which the relevant details had to be abstracted, unlike the pictures of people and birds used in the experiments reported in Chapters 5 and 6 which could be considered as wholes. The experiments using geometric figures required properties of these to be abstracted, but these figures were very simple. The only comparably complex stimuli requiring analysis used in the course of this work are those used for Claparède's task in Chapter 2. That task was also found to be difficult, especially by the younger children. An argument has been put forward in previous chapters suggesting that children as young as those employed in the present experiment may have difficulty in perceiving aspects of a stimulus separately from the whole. The simple fact that it is odd to have, for example, differently coloured gloves, may also have led to difficulty although, as previously noted, the children did not spontaneously remark on this oddity.

The writer does not feel that an adequate explanation for the difficulty about half the subjects experienced in performing the task has been found, but it must be accepted as an unfortunate fact, effectively reducing the amount of data from which conclusions can sensibly be drawn.

Such conclusions as can be drawn must now be considered. It was hypothesised that some children would show a tendency to treat 'different' as 'same' which would not be shown for 'prebble'. The difficulty in testing this hypothesis was that such a tendency might not be shown by the sample as a whole, because of the inclusion of children who understand 'different' correctly, while to look at the tendency to pick 'same' items in response to 'different' and 'prebble' only among those who pick at least 50% 'same' items as 'different' would clearly be biased in favour of the hypothesis. The hypothesis was tested, and found to be supported, by showing that the children who tended to pick 'same' items in response to 'different' instructions had more statistically unlikely response patterns for their 'different' responses than for their 'prebble' responses, regardless of whether they made more 'same' or more 'different' selections for 'prebble'. The same was true for those subjects who picked 'different' items as 'different'.

Only a few children had response patterns that were very different from chance for any of the terms. Eleven children had response patterns which satisfied the criterion for understanding 'same', none treating 'same' as 'different'. Five children apparently understood 'different' and four treated it as if it meant 'same'. Two children treated 'prebble' as 'different', one of them having been told that that was what it meant. Although these results are too few, taken on their own, to establish that young children are more likely to assign the meaning 'same' to 'different' that they are to a nonsense word, neither do they provide any direct evidence that a nonsense word would ever be treated as if it meant 'same'. Only one child appeared to assign a consistent interpretation to a nonsense word and he seemed to interpret it as 'different'. Four of the five children who understood 'different' also understood 'same', while three of the four who interpreted 'different' as 'same' apparently did not understand 'same', suggesting that true understanding of the terms may go hand in hand more often than has been evident from previous experiments. There may be a period of uncertainty initially combined with a tendency to treat both terms as meaning 'same' followed by realisation of their different meanings either simultaneously or in rapid succession. It is worth noting that the one child who treated 'prebble' as 'different' without being told that that was what it meant, apparently understood 'same' but supplied no consistent interpretation of 'different' as either 'same' or 'different'. This child may have thought that since he had been asked about things which were the same, 'different' was a likely meaning for one of the terms he did not know, but opted for the wrong one. It is possible that some apparently correct interpretations of 'different' in this and previous experiments are due to the same reasoning, though this is speculative.

It is surprising that there were not more objections to 'prebble'. A child of this age must often hear words he does not understand and could not question each one but one might have expected a query when the child was required to follow an instruction containing an unknown term. The tendency simply not to respond rather than to voice an objection may reflect an inability on the part of the subjects to analyse their own failure to understand and locate it in one word. Most children however, did respond, without question. Nonetheless, the fact that refusals to respond to 'prebble' were significantly more common than to the other terms and in particular the very low rate of such refusals for 'different' suggests that 'different' was recognised as a real word by most subjects.

The paucity of consistent results obtained from this experiment dictates caution in their interpretation. However, they do seem to show a tendency to treat 'different' as meaning 'same' not shown for a nonsense word. The possibility that a nonsense word might appear to be assigned a consistent meaning was also shown, but only by one child.

Section IV. Conclusions.

Chapter 8. General discussion and conclusions.

Throughout this thesis there have been two themes: the nature of similarity and difference, and the nature of awareness, the two themes meeting in considering the degree to which the children showed their awareness of similarities and differences in the various situations. Underlying their cognitive understanding of these relations has been their linguistic understanding of the words 'same' and 'different' themselves which has always had to be taken into account. This final chapter presents a further consideration of the two themes and relates them to the experimental findings. Before commencing this it seems appropriate to summarise the conclusions of earlier chapters, which at once stimulate and constrain the speculations of this chapter.

Summary of findings.

Section I is based on Claparède's 1918 paper 'La conscience de la ressemblance et de la différence chez l'enfant'. Although Chapter 1 gave various objections to his theory, his findings were amply supported in Chapters 2 and 3: many of the children, especially the younger ones, had difficulty in giving similarities between two items and they sometimes gave differences instead, more often doing so when the items to be compared were more dissimilar. Binary comparisons, e.g. 'Is a bee more like a fly or a bird?', led to better answers than simple comparisons. Any point of contact between the two items was sometimes given instead of a true similarity, these answers being called relations here. Chapter 3 showed conclusively that differences are easier to give than similarities, as Claparède had plausibly asserted, but had not definitely shown, and showed also that although it is easier to take the problems in an order which makes errors due to perseveration less likely, such errors do not wholly account for the greater difficulty of giving similarities between more dissimilar pairs. The degree of dissimilarity did not significantly affect the difficulty of giving differences.

It had been expected that Claparède's findings would be replicated and it was hoped that some further insight would be reached into what was happening when a child attempted his task. Claparède gives reasons why differences should be easier than similarities but these are not always convincing and he does not explain why differences should be given when similarities were requested, or why binary comparisons should be easier than simple ones. Of the theories explored in Chapter 2, Rosch's theory of the nature of categories was found to be the most helpful. Although this is not a theory of awareness and Rosch has denied (e.g. Rosch 1978) that it is a processing theory her findings suggest that our awareness of objects is most naturally in terms of their basic level category membership and in terms of prototypes for those categories. Adults can conceive of objects in other terms but take longer or make more errors in doing so. Rosch's theory provided a way of conceptualising what the children were doing in carrying out Claparède's task. It was suggested that giving a similarity between two objects required the child to form a category containing the two and giving a difference required putting them in two different categories even if those categories are defined only by the similarity or difference offered. If the appropriate categories are natural basic level ones the child will automatically think in these terms without extra effort. Since most pairs of objects to be compared were members of two different basic level categories it was almost always going to be easier to give differences between them than similarities for this if for no other reason.

If an appropriate answer cannot be given in terms of basic level categories, some other category or categories must be used. Forming a category uniting two objects which are members of different basic level categories is more difficult than forming two subordinate categories for members of the same basic level category as in the latter case the names of the items suggest the appropriate categories. Similarly, binary comparisons are easier than simple ones because they suggest the categories to be formed and taking similarity problems in order of increasing similarity rather than the reverse can also give hints as to the appropriate category.

The children normally answered in terms of the prototypes of the categories they were using, whether these categories were appropriate or not. Pictures of the items, when used, provided a source of non-prototypical answers. It appeared that not all properties of the prototypes were equivalent, some being more salient or accessible than others, this saliency being affected by the context of the comparison. Colour, shape and size seemed to be salient properties, accounting for a high proportion of answers.

The children sometimes seemed to be tempted into making errors by particularly salient properties. They also showed a tendency to try to give the same kind of answer to successive problems in a series even when this led them into error. It appeared that they were not fully in control of their own cognitive processes and lacked the flexibility that would come with such control.

Section II looked at children's ability to judge whether or not two things were the same or different, according to definitions imposed by the experimenter, and to select objects which were the same as or different from a target and justify their choices. The effects of different kinds of stimulus materials were investigated and the rôle of awareness was not forgotten.

The first experiment in the section produced the findings that when asked to select from among cards showing geometric figures the children tended to choose cards which had more properties in common with the target than different from it as both 'same' and 'different' and that 'same' selections were significantly more similar to the target both than 'different' selections and than would be expected by chance. The absolute number of appropriate justifications was about the same for both 'same' and 'different' selections indicating that those for 'different' selections were much better when considered relative to chance. About half the children concentrated on one property of the figures in justifying their selections and this often led the younger ones into the errors of giving similarities when differences were required or vice versa. It seemed as though 'same' selections might be made holistically and 'different' ones analytically, which was suggestive of Garner's (1970) distinction between integral and separable perception. Separable perception, that is, perception in terms of dimensions, would facilitate justification because particular dimensions of comparison would be present to awareness. It was suggested that separable perception might be more common among the older children and that it might be promoted by looking for differences rather than for similarities.

The second experiment reported in Section II (Chapter 5) looked at children's judgements as to whether two cards showing six pictures each were the same or not, or different or not, and at the evidence the subjects collected before making these judgements. 'Same' judgements (i.e. judgements whether the two cards were 'the same' or 'not the same') were more often correct than 'different' judgements but this could have been due in part to the definition of 'same' imposed by the experimenter being more natural to the children than that for 'different'. Overall there was a tendency for the children to collect too little evidence for their judgements to be soundly based but the older children were more likely to collect more information than was necessary. The general undercollection of information was less marked for 'different' than for 'same' judgements. Only one child performed optimally in gathering evidence for his 'same' judgements and he and two others did so for 'different' judgements. The reasons for this poor performance were not altogether clear but the hint that information gathering performance was better for 'different' judgements than for 'same' ones is consistent with the notion that dealing with differences encourages awareness.

A higher proportion of children treating 'different' as if it meant 'same' was found in the experiment just described than in the first experiment in Section II, and a few subjects were found who made this error in one condition but used the word correctly in the other condition. This suggests that some form of regression to an earlier error is possible under certain conditions and hints at a deficiency in access or monitoring functions. Chapter 6, the last in Section II, reported on an investigation as to whether this difference between the two earlier experiments was due to the difference in task or in stimulus materials employed in them. The findings supported the view that it was the judgement task which led to the higher proportion of this error but other results pointed to the effects of the stimulus materials. The distinction between integral and separable perception was again brought in to explain these latter findings.

Sections I and II are principally concerned with the children's appreciation of similarity and difference as such but their understanding of the words 'same' and 'different' is obviously relevant. Findings concerning this understanding will be considered here, along with the one experiment reported in Section III.

Understanding of 'same' appeared to be very good throughout Sections I and II. However, one child in one condition in the experiment reported in Chapter 5 appeared to treat 'same' as if it meant 'different' as well as vice versa, and some children contributing to Chapter 6 did not clearly show that they understood 'same'. Also there is always the possibility that the design of the experiments led to the appearance of complete understanding when this was not actually present.

Comprehension of 'different' however was clearly not perfect. In all the experiments in which the term was used a small proportion of the subjects appeared to interpret it as if it meant 'same'. As noted above the size of this proportion seemed to depend on the circumstances of testing. The experiment reported in Section III was designed to investigate whether the interpretation of the previous results as the children believing that 'different' means 'same' is correct, or whether the appearance of that belief results from a combination of total non-comprehension of 'different' and some response bias. This was done by comparing responses to 'different' with responses to a nonsense word. 'Different' was recognised as a real word by the subjects: the nonsense word elicited significantly more refusals to respond than any of the three real words used in the experiment and while the real words did not differ significantly from each other in this respect 'different' actually called forth the fewest refusals. The children were more likely to respond to 'different' as if it meant 'same' than they were to the nonsense word. There was little evidence of systematic responding to the nonsense word but one child appeared to treat it as meaning 'different'.

Response to 'same' in this last experiment was poor. While this was thought to be due partly to the nature of the stimulus materials it may indicate that the previous apparent high levels of understanding were aided by the structure of the experimental situations. It seems then that children have some difficulty with both the terms 'same' and 'different' in their early years. These difficulties, especially the interpretation of 'different' as 'same', may be universal at an age somewhat earlier than that of the youngest subjects to be tested in the course of this work. Some children may acquire a firm understanding of both terms at about the same time. This is suggested by the finding of Chapter 7 that children who correctly understood 'different' typically showed understanding of 'same' while those who treated 'different' as 'same' typically did not understand 'same' itself. However, it seems that difficulty with 'different' may continue for a longer period: certainly it was only with 'different' that there was clear evidence of problems in the school years.

The issue of the children oscillating between two interpretations of 'different', as 'same' and as 'different' will be returned to when the general theme of awareness is considered.

Similarity and difference.

At this point some further consideration of the nature of similarity and difference is appropriate. From a logical point of view these two relations would seem to be simply complementaries of each other. This does not seem to be so from a psychological aspect, however. It has been shown (Tversky 1977) that even adults, when asked to judge similarity and difference, do not treat them as straightforward complementaries and there is ample evidence in this thesis that children do not do so.

The notion that subjects tended to assess similarity in a rather holistic fashion and difference in a much more analytic way was suggested by the results of the experiments in Section II. In these experiments the children's judgements and selections were necessarily based on their perceptions of the stimulus material and Garner's distinction between integral and separable perception seemed an appropriate explanatory concept. An account based on perception can be generalised to conception (for instance, performing Claparède's task, presented verbally), if the latter is thought of as proceeding through the medium of images. This may however be a trap one should not fall into: it is easy to think of Claparède's task in terms of comparing images of prototypes but Rosch has made it clear (e.g. Rosch 1978) that prototypes are not images or imagable entities. This is most obvious with prototypes for superordinate categories. If it is desired to give the same kind of explanation for the results of Claparède's task as for those of the perceptually-based experiments some more general notion is required. It may be that similarity tends not only to be perceived, but also to be conceived in an integral fashion and difference tends to be conceived in a separable fashion.

Garner (1974) insists that integrality and separability are stimulus properties, so his theory is necessarily limited to perception. However, he himself noted that subjects were occasionally able to choose whether to handle certain kinds of material in an integral or separable fashion and as described in Section II several investigators have shown a developmental change from integral to separable perception. These results indicate that some distinction in mode of processing must be located in the organism, and such a distinction may be more general, not limited to perception alone. Garner (1970) proposes as a limiting definition of integrality that 'two dimensions are integral if in order for a level on one dimension to be realised, there must be a dimensional level specified for the other' but Shepp (1978) suggests that the colour of a door drawn on a card can be integral with the shape of a window in the door for young children, which clearly does not conform to the definition. This also suggests that workers in developmental psychology may have got hold of a distinction which is related to but not identical with the distinction between integral and separable properties.

Brooks (1978) offers a distinction between analytical and analogical modes of processing which may be a candidate for a general theory of cognitive function similar to Garner's perceptual theory. Brooks is concerned with category formation and judgements of category membership, and contrasts cases where these proceed by analysing instances into their component properties with those where they occur by analogy to particular instances taken as wholes. The relationship of this distinction to the way in which the treatment of similarity and difference has been contrasted above is obvious. Brooks gives a number of arguments in support of his case that analogy is both a common and an efficient process for handling complex material in natural situations. He relates his analytic/analogical distinction to that between integral and separable dimensions by noting that analogy will be particularly appropriate in cases where similarity relations are primary, i.e. those which favour integral perception, although he believes that analogical processes are used much more widely than this. He makes no claims about the course of development of the two processes but from a passing remark that children learn to read 'at an age not well-suited to analysis' it may be assumed that he believes analysis to develop later than analogy.

The results reported in this thesis are consistent with the idea that older children are more likely to use analytic processes than younger ones and that there is some tendency for subjects to use analogical processes when dealing with similarity and analytic ones when dealing with difference. The latter point requires further consideration on two counts. Firstly, is it correct to assume, as it has been so far, that the observed differences are due to the nature of similarity and difference as such, or might they simply be a consequence of the kinds of things the subjects have been asked to compare? Secondly, if there really is such a contrast between similarity and difference, is it possible to find any explanation of why this should be so?

The objects which have been compared have been quite various. In Claparède's task the items compared were almost always members of different basic level categories and it has been suggested that this alone would make it easier to give differences between them than similarities. However this explanation does not hold for the figures of humans and birds used in Section II and its application to the geometric figures used in that section is uncertain. The contrast between similarity and difference for the subjects was most marked in Claparède's task but persisted in some degree in the other experiments and so does not seem to be an artefact of the stimulus materials employed.

It seems than that there is a genuine difference in the way in which similarity and difference are handled and an explanation for this must be sought. To this end it is worth considering situations in which objects are naturally compared. As Claparède points out, most natural comparisons are made unconsciously, but it is comparison with awareness with which we are concerned here. The most common situation in which comparisons are made is in deciding which of two or more objects is most suitable for some purpose. The objects and purposes are of course enormously varied: they may be tools to open a crate, dresses to create an impression at a party or theories to explain a set of data. What all such situations have in common is that there is, necessarily, some similarity between the items to be compared in that they are all potentially capable of serving the purpose in question. This similarity is simply assumed as the basis of comparison and the objects are then explicitly compared for their differences. Not only is it differences of which we are required to take cognisance in such a situation but the differences are likely to be individual properties of a relatively superficial nature while the similarity is more fundamental and more complex. When two objects are capable of serving the same purpose the similarities between them which make this so may be quite numerous. Taking the example of opening a crate suggested above, potential levers must all have a certain strength, have certain aspects of shape enabling them to be inserted under the lid and manipulated, must not be too heavy to handle and so on.

Differences between possible levers, such as that one is longer than another, are much more likely to be simply specifiable in terms of individual properties.

There are of course situations in which we look for similarity. If hammering is required and no hammer is available we look for something else that will serve the purpose and here again the similarity between the objects compared is more fundamental than any differences. Situations in which we look for similarities which are relatively superficial, such as choosing curtains to match a carpet, are probably quite rare. So it seems that looking for differences is more common than looking for similarities in naturally occuring conscious comparisons and that the similarities which are looked for in these situations are more fundamental and more complex than the differences which are sought. In this case the result reported from the selection experiments that items selected as being 'different' were of about average similarity to the target (in one experiment) or greater than average similarity (in the other) rather than being markedly different from the target, is not surprising, since the subjects would have been accustomed to looking for differences only between things which are basically somewhat similar.

It does then seem that there is a real difference between similarity and difference in the way in which they are normally used which makes analogy a more appropriate process to deal with similarity and analysis more appropriate to deal with difference in most cases. However, as the children's analytic abilities develop with age they should become better able to analyse the mass of properties which forms the basis of similarity between two items into at least some of its component parts. Some properties will be easier to analyse out than others, because they are more superficial or detachable from the overall mass. This point is reminiscent of Piaget's (1977) claim that awareness proceeds from the periphery to the centre, the suggestion being that it is analysis which proceeds from the periphery to the centre.

Although naturally occuring comparisons of similarity are not likely to be such as to favour analysis the materials used in the course of this work have varied in this respect. At one extreme are the geometric figures which it would be natural to an adult to handle in terms of their individual properties rather than overall similarity relations. The individual figures of humans and birds used in Section II did not require analysis in order to perform the tasks. It is not surprising that it was found to be easier to give similarities for these materials than it was in performing Claparède's task.

The account being proposed here offers an explanation of the differences in the way the children used different physical properties. In Chapter 3 it was found that the children often mentioned the properties colour, shape and size in giving similarities and differences between objects. Shape was the most popular as a similarity, followed by colour, and colour, followed by size was most popular as a difference. Similarly, in dealing with the geometric figures in Section II the children tended to select items of the same shape as both 'same' and 'different' while 'different' selections tended to differ from the target in pattern. In judging the same figures a common shape led to the most judgements of 'same' and 'not different' while a common colour led to the fewest such judgements, some children indicating by their comments that they did not consider a difference in colour important enough to prevent a judgement that two figures were 'the same'. It is likely that, even when dealing with individual properties, the children would think in terms of superficial properties as differences and fundamental ones as similarities. As suggested in other chapters shape seems the most fundamental of these physical properties. Of all individual properties it is the one which comes closest to representing the complex essence of things which is the basis of overall similarity.

Implicit in what has been said above is the notion that analytic processing favours awareness of the basis of comparison while analogical processing does not. This must be developed and made explicit. It is in the nature of analogical processes that they do not actually identify a specific basis of comparison. Analogy works simply by overall resemblance without picking out any particular point of similarity and therefore no such specific point can be available to awareness. It is true that there is less awareness with analogical than with analytic processing but this is due to the nature of the processes, not to any deficiency in the functioning of awareness in the children.

Awareness.

This brings us to the second main theme of this thesis, which is awareness. Some findings have suggested explanations in terms of the concepts used by workers in artificial intelligence and human information processing - concepts such as control, access and monitoring. Some consideration of what has been said about awareness by writers in these fields might consequently be relevant.

Shallice (1978) aims specifically to provide an account of awareness in these terms and so his theory will be presented here. It has much in common with the views of other writers in the area (e.g.

Lindsay and Norman 1977, Mandler 1975, Sloman 1978) and it is inappropriate to discuss and evaluate the differences here.

Shallice sees awareness as necessary in order to avoid conflicts: since certain activities, both physical and cognitive, are incompatible with each other, some mechanism is required to prevent the attempt to carry out such activities simultaneously. While there does not seem to be any logical necessity for awareness in order for this function to be performed it may in practice be the mechanism used by human beings and some other organisms to avoid such conflict.

In Shallice's theory our activity, physical or otherwise, is controlled by action systems which are analogous to computer programs. These action systems can be at many levels: controlling finger movements in writing, deciding what words to write, deciding whether to write a letter of resignation or a proposal of marriage at all. More than one action system can operate at once - it is possible to walk and talk at the same time, for instance, but there is always one action system which is dominant and which has control of all the apparatus (e.g. muscles, memory stores) which it needs. Any lower level action system which is able to operate simultaneously with the dominant action system is free to do so.

Shallice identifies awareness with the input to the dominant action system. Awareness can therefore be at a number of levels, but no higher level action system can function simultaneously without awareness. The dominant action system at any moment is the one which is most salient. Salience in this sense is said by Shallice to be a product of importance and feasibility but he does not specify how the organism arrives at importance and feasibility quotients or combines them. The dominant action system can be selected by a higher level system as a subroutine, control being passed back when the lower level system has completed its task. In such cases we are aware of the activity of the lower level system as being willed. A higher level system must be able to ascribe importance, and consequently salience, to a lower level system, although Shallice does not state this. Certain inputs from the environment, such as the telephone ringing, can also select the dominant action system. Such a provision is obviously necessary to prevent the organism ignoring important, possibly life-threatening, events when absorbed in other activities.

Some of the findings in this thesis can be viewed as indicating failings in awareness on the part of the subjects. There is no reason to suppose that development of the functions of awareness is complete in the young child, any more than is his intellectual or physical development. Such failings will now be considered, using Shallice's model as a guide to the working of awareness.

On Shallice's model, awareness will only function properly if the appropriate action system is dominant, yet it is difficult to see how this could be ensured. Also, higher level action systems, when dominant, must be able to call in appropriate subroutines, and control must be passed back to the higher level system at the appropriate moment. Some of the reported deficiencies could be explained along these lines.

For example, there were a number of instances suggesting perseveration. In Claparède's task a subject would often give the same answer to several successive comparisons, even when this led to a reversal error (giving a difference when a similarity was requested or vice versa). Sometimes exactly the same answer was not given, but a child would stick to one kind of answer for several comparisons, always answering in terms of colour, for example. Similarly, the children would often use a single property in justifying most or all of their selections of geometric figures, and there were many cases, especially among the younger children, in which this led to reversal errors. It seems that for these subjects a once appropriate dominant action system retains its dominance when no longer appropriate.

The children performing Claparède's task appeared to find it difficult to conceive of items other than in terms of their basic level prototypes. This suggests that prototypes have a very high degree of salience, which is consistent with Rosch's findings for adults. It may be that prototypes have a permanently high importance quotient but that young children are unable to modify their feasibility levels appropriately. The children contributing to Chapter 2 appeared able to use the pictures as alternatives to prototypes, suggesting that perceptual information may acquire sufficient salience to become dominant though even here there were a few instances in which the prototype apparently retained dominance.

Not all reversal errors can be explained by perseveration. It seems that the request for a comparison of either similarity or difference activates, or causes to become salient, action systems which look for comparisons of both sorts. It was suggested in Chapter 2 that reversal errors arose when a point of comparison of the wrong sort was particularly salient. A property that was salient in this sense would be salient in the sense used by Shallice also. Introspection suggests that such salient properties might well become dominant, that is, occur to mind, for adults also but would not be given in error because control would be referred back to a higher level system before an utterance was produced.

In the judgement experiments many children did not accept the definitions of the critical terms laid down for them by the experimenter and made clear (it is hoped) by examples. This was especially true for 'different' for which the required definition was admittedly less natural than that for 'same'. It does not seem likely that the subjects were unable to understand these definitions, rather that they were unable to employ them on demand. Individual word meanings are typically employed without awareness but when a definition is imposed from outside in this way awareness may be necessary. Being given the definitions should build into the dominant action system the requirement that when the terms 'same' and 'different' are used they are to be interpreted in accordance with those definitions, which would be called in as subroutines. This would be similar to the experience of a dominant action system as willed, which Shallice describes, but the process evidently fails in most of the subjects and their own more usual definitions are employed instead. The fact that a majority even of the oldest age group of subjects is involved suggests that this kind of linkage between action systems at different levels may be particularly difficult.

Most subjects failed to collect the appropriate amount of evidence for their judgements in the experiment reported in Chapter 5. This could arise in a number of ways. If the children are not employing any particular interpretation of 'same' and 'different' with awareness they cannot collect information appropriate to such a definition, though the requirement to collect evidence should encourage them to think about their definitions. They could be aware of the definition they are using but simply unable to reason out the connection between that and the evidence. However there were a number of cases in which the children collected the appropriate amount of information on a fair proportion of trials but not on all. Some such cases could have arisen by chance but it seems unlikely that they all did. This suggests that deciding on the information to be collected was effortful and that they were unable to sustain the effort. In terms of Shallice's model it would be the feasibility of the appropriate action system which was affected.

One more finding will be considered here. This is that some children appeared to have both 'same' and 'different' stored as possible meanings for 'different' and which of them was accessed on any particular occasion seemed to depend in part on the nature of the task. These different interpretations can be considered as different action systems, employed as subroutines to higher level systems. They might or might not become dominant themselves: it was suggested in Section II that use of the correct definition might require awareness, that is, dominance. A possible explanation for the finding is that the selection task requires a higher level of system to be dominant that the judgement task and that the correct definition is only available as a subroutine to relatively high level systems. This would be true if it were itself at a high level. Intuitively it seems possible that a newly acquired definition is stored at a higher level than a long-established one. Since many words have more than one meaning an earlier definition would not be automatically wiped out when a later one was acquired, though in this instance one might have expected it to be somehow tagged as incorrect. This finding is however a puzzling one and any explanation for it must be speculative.

Introspection suggests that the experience of awareness at different levels differs and it seems natural to speak of higher and lower levels of awareness itself. Addressing the problems of philosophy with awareness seems so much more exalted than tying one's own shoe-laces, albeit with awareness. Because the dominant action system has access to and control over lower level systems but not higher level ones awareness at a high level has many more connections than awareness at a low level, which is a part of its sophistication. It was noted in Chapter 1 that Piaget (1977) speaks of degrees of awareness, the amount of awareness depending on the extent of integration, and this is essentially the same point. The processing model maintains an all-or-none character for awareness, while at the same time admitting of degrees such that some levels of awareness allow rational thought, for instance, while others do not. The appearance of irrationality can arise from the dominant action system being at too low a level. This is the case, for instance, with a child who occasionally gives a difference in error for a similarity: he is aware of what he is saying, but his awareness is not at a level high enough to tell him his answer is inappropriate.

The writer would not wish to put too much store by the detail of Shallice's account but the general principles seem to fit the findings reported here and help to make them intelligible. Any mechanical or computing model for awareness would make occasional breakdowns not only understandable but probable; it is perhaps more to be wondered at that in the adult the system normally works so smoothly and so flexibly.

This thesis is entitled 'Development of linguistic and cognitive aspects of the understanding of similarity and difference'. As to linguistic aspects, the development is not necessarily complete for either of the terms 'same' and 'different' in the age range studied, though deficiencies in the understanding of the latter term were much more widespread. In particular there was evidence of systematic misunderstanding of 'difference', not merely a lack of correct understanding. Cognitively, it has been shown that similarity is more likely to be handled analogically and difference to be handled analytically. The gradual development of analysis of similarity gives the appearance of a gradual development of awareness of similarity. Awareness is not to be expected with analogy, but some errors indicated genuine slips in the functioning of awareness.

Claparède wrote in 1918 that the birth of awareness of similarity in the child was veiled in darkness; perhaps that veil has been lifted a little, and the scene is no longer wholly dark.

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