EFFECTS OF INSTRUCTIONS ON ORGANIZATION AND RECALL IN CHILDREN OF LOW AND MIDDLE SOCIO-ECONOMIC STATUS

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ABSTRACT

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Conceptual ability in five-and seven-year old children of low and middle socio-economic status (SES) was investigated by assessing recall and clustering in free and cued recall tasks. Each subject's preference for either the function or the colour dimension of pictured objects was determined, and then the child was allowed to handle the experimental materials under neutral instructions or was instructed to organize these materials along his preferred or non-preferred dimension in preparation for recall. Results showed that clustering in free recall was predominantly along the function dimension, and that where preferred instructions facilitated performance, they were generally function instructions. As expected, seven-year olds remembered more than five-year olds, although clustering scores were no different. There was no difference between the SES groups in amount recalled, and while clustering was greater for middle SES children during free recall, cued recall results suggested that amount of grouping during encoding was similar for the two SES groups.

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TABLE OF CONTENTS

Page

INTRODUCTION

When presented with a list of words to be learned, adults have a general tendency to encode and store the items in organized conceptual groups (Mandler, Pearlstone, & Koopmanis, 1969; Schuell, 1969). Such organization during encoding facilitates the retrieval of items in recall. Young children do not seem to employ organizational strategies but rely entirely on basic memory span, thereby severely limiting the number of items they can recall (Bousfield, Esterson & Whitmarsh, 1958; Moely, Olson, Halwes & Flavell, 1969). It is not clear at which phase in the child's learning process organization is blocked. If the child does not yet firmly possess the particular classification scheme required to categorize items in a given list, he is unlikely to organize the information. Alternatively, the child may have great facility in classifying information along a given dimension, but he may not spontaneously categorize when he is encoding a list of words. Finally, the child may organize items during encoding but may not spontaneously use organizational strategies to aid retrieval. Whatever the source of the difficulty, studies with children of middle socio-economic status (SES) have shown that by age ten the child spontaneously utilizes organizational strategies to facilitate learning (Kobasigawa & Middleton, 1972; Moely, Olson, Halwes & Flavell, 1969). There is some indication that the developmental acquisition of organizational strategies is limited to the child of middle SES, and that the low SES child continues indefinitely to rely on rote or basic memory(Jensen, 1969; Jensen & Frederiksen, 1970). Evidence from Jensen's laboratory has suggested that although young children of low and middle SES show little difference in performance on free recall tasks involving conceptual ability, class differences on such tasks become apparent when the middle SES child begins using organizational strategies.

Jensen (1969) has argued that Level I, or basic associative memory, is equally distributed between children of low and middle SES, but that Level II, or the conceptual learning ability that is required for organizing information, is disproportionately distributed, with low SES children having great deficits in Level II ability. To substantiate his hypothesis, Jensen (1969) discussed free recall studies conducted in his laboratories in which 20 unrelated objects were presented for subsequent recall to both low and middle SES children. He stated that on such a task, designed to capitalize on basic memory and preclude concept utilization, low SES children performed as well as those of middle SES. Jensen then cited a free recall study by Glasman (1968) in which a list of 20 items that could be classified readily into four distinct categories was intended to activate conceptual organization. On this task both organization measures and recall scores were much greater for middle than for low SES children.

As a follow up to Glasman's experiment, Jensen and Frederiksen (1970) conducted a study in which they compared the performance of low and middle SES children on three list conditions: a) an uncategorized list designed to elicit Level I ability, b) a randomly presented categorized list to measure Level II ability, and, c) a blocked categorized list to examine

Level II differences between the effects of b and c. Jensen and Frederiksen found no significant differences between SES groups in recall and organization measures on the uncategorized list, while differences in both measures were significant on the randomly presented categorized list. The authors interpreted these data as supporting Jensen's hypothesis. However, they failed to take into account a third finding: the lack of significant differences between children of low and middle SES on the blocked categorized list, and the fact that the low SES subjects improved somewhat more from the randomly presented to the blocked categorized list condition than did middle SES subjects. This suggests that low SES children may in fact be capable of significant improvement in Level II abilities with altered teaching techniques or methods of presenting material.

Jensen has suggested that learning to make use of conceptual categories or clusters is not simply a matter of experientially acquiring appropriate strategies, but depends on the existence of specific neural structures, and that low SES individuals are genetically deficient in these structures. He has concluded that for best results the teacher should capitalize on the rote memorization abilities of the low SES child and not waste time in attempting to teach him the cognitive or conceptual processes which are accessible to the middle SES child, but which are beyond the potential of the low SES child.

In the present study Jensen's conclusions are questioned on the following grounds:

1. Low SES children may be capable of organizing information conceptually but may fail to do so because the relevant conceptual dimension is not salient for them. In a learning task consisting of items

classifiable along a dimension salient for low SES children, organization of material my become evident.

2. Low SES children may be capable of learning to organize information conceptually, but they may not do so spontaneously in a learning task. If this is the case, appropriate instructions should activate organization.

3. Low SES children may organize information for encoding, but may fail to use encoded organization spontaneously at retrieval. With retrieval cues, such organization should become manifest.

Dimension Preference

There is some indication that children perform better in concept attainment and identification tasks when a preferred dimension rather than a non-preferred dimension is relevant (Mitler & Harris, 1969; Suchman & Trabasso, 1966). When Odom (1972) tested the effect of perceptual salience as either a relevant or incidental dimension in a recall task, he found that recall was facilitated when the salient dimension was relevant.

The standard technique for tapping preferences requires the subject either to sort pictures into groups that "go together", or to select one of several picture cards that is "most like" a given standard. Competing stimulus properties have generally included colour, form, number and size, with studies comparing the relative salience of colour and form being most frequent. The accumulated evidence on colour and form preferences indicates that there are developmental changes in dimension salience, with preference for colour developmentally preceding, and eventually being superseded by preference for form, and with most children completing the transition sometime between the ages of five and seven (Brian & Goodenough, 1929; Corah, 1964; Harris, Schaller & Mitler, 1970).

Birch and Bortner (1966) compared preferences of concrete properties (form and colour) with more abstract attributes (class or function) of three-dimensional objects in children aged three and ten years. Children were presented with an index object and three stimulus choices, one of which corresponded to the index object in terms of class or function, while the other two objects were similar in colour or form. The majority of children did not categorize primarily by class or function until the age of six.

Bernstein (1961, 1968) has suggested that lower class children attend more to the concrete properties of objects while abstract properties are generally more salient for middle class children. Although there is little else in the way of evidence providing a distinction for dimension preferences between low and middle SES children, it seems plausible that differences in environmental conditions between SES classes could lead to different ways of perceiving stimuli, and that such differences in perceptual orientation might influence organizational processes in learning. Using Bernstein's work as a guide, the present study compared the salience of colour with that of function or taxonomic class in children of low and middle SES. (For convenience, "colour" and "function" preferences are referred to throughout the rest of this paper).

Free Recall

The literature on memory processes in free recall tasks suggests that to follow Jensen's advice and teach low SES children primarily by rote methods may unnecessarily deprive them of the opportunity to acquire efficient learning strategies.

In the typical free recall paradigm, the subject is presented with a list of words, which he is required to recall in any order after a predetermined period of time. Regardless of the order of presentation, there is a strong tendency for words that are conceptually related to appear contiguously in the output list. This tendency of related words to appear together is referred to as clustering and is considered to be a manifestation of active organizational processes involved in memory (Mandler et al, 1969). Studies of free recall in adults consistently show that such conceptual organization of material is a key factor in facilitating memory processes. Increases in organization of to-be-remembered items (as manifested by clustering in the output list) are consistently accompanied by increments in the number of items recalled (Bousfield & Cohen, 1953; Mandler et al, 1969; Tulving, 1962). In a study by Mandler (1967), subjects who were asked only to sort words into categories remembered as many words as did another group of subjects who were explicitly instructed to memorize the words.

One explanation of how clustering facilitates recall is based on Miller's (1956) chunking hypothesis. Miller argued that immediate memory was limited to about seven units in the human adult, but that each of these units could contain one bit or several bits of information.

The memory load created by a large number of items can be reduced to a smaller number of higher-order units if information is organized and stored in chunks or categories. Upon retrieval the items belonging to any single category are available in a convenient, efficiently packaged form that may be elicited by the category heading alone. Miller's hypothesis is consistent with the results of many free recall studies (Bousfield & Cohen, 1953; Mandler et al, 1969; Segal, 1969; Tulving, 1962). For example, Segal (1969) reported a study in which the stimulus list, in addition to containing words belonging to a number of explicit categories, also included words considered to be descriptive of each category as a whole. In this situation subjects tended to recall the category title word immediately before recalling the items in the category. Packaging items into unified clusters increases the limit to the number of individual items in the immediate memory span, thereby producing more efficient learning.

Studies of free recall in children have shown that the number of items recalled increases reliably with age (Bousfield, Esterson & Whitmarsh, 1958; Cole, Frankel & Sharp, 1971; Kobasigawa & Middleton, 1972; Laurence, 1966; Neimark, Slotnick & Ulrich, 1971; Rossi, 1964; Shapiro & Moely, 1971). Some of these investigators have found concomitant increases in measures of organization (Bousfield et al, 1958; Kobasigawa & Middleton, 1972; Neimark et al, 1971; Rossi, 1964), while others either have had equivocal results or have found the developmental increases in recall without the accompanying increases in organization (Cole et al, 1971; Laurence, 1966; Shapiro & Moely, 1971). It is of course unnecessary to postulate organizational factors in developmental increments in recall, as older children can be expected to remember more items than younger children on the basis of maturationally increased memory span alone. Where developmental increases in recall are accompanied by increased manifest organization, both maturationally increased memory span, and improved strategies for utilizing organization must contribute in some proportion.

For the moment one can only speculate on the factors that might activate a child's spontaneous use of organization to facilitate recall. However, one must not make the mistake of assuming that because the child does not spontaneously organize information, he is incapable of learning to do so. When a child displays no evidence of organization in free recall, he may be exhibiting a production deficiency (Flavell, Beach & Chinsky, 1966) in that he fails to order items into categories spontaneously during encoding, but is capable of learning to do so when the possibilities and advantages of organization are made clear to him. Alternatively it is possible that the child who manifests no organization in the output phase of a free recall task is suffering from permanent and irreversible production deficiency. This is the position Jensen appears to hold with respect to low SES children.

Moely, Olson, Halwes and Flavell (1969) found that young middle class children who did not spontaneously organize material could be taught to do so. In their study, children in kindergarten, grades one, three, and five were free to manipulate pictures of objects which they were to learn for subsequent recall. The three younger groups did not spontaneously organize the pictures into categories while the grade five subjects did. Observable organization during the study period corresponded directly to the amount of clustering on the recall list, which was minimal for the three younger groups and showed a sharp increase for subjects in the fifth grade. In another condition subjects in all grades but the fifth were given training in spatially organizing the pictures into conceptual groupings during the study period. Both recall and clustering were significantly greater than in the no-training condition. Furthermore, trained subjects performed as well as control fifth-grade subjects, independent of grade level. The results thus suggest that the children had had a temporary and reversible production deficiency, since all groups of subjects were able to acquire conceptual grouping skills, and to benefit from such organization at the time of recall.

Since experimental training procedures used by Moely et al (1969) as well as others (Kobasigawa & Middleton, 1972) have been effective in accelerating organizational processes in middle SES children, it seems reasonable that similar teaching procedures might be effective in inducing organization in low SES children provided the failure of such children to organize is due to a reversible production deficiency and is not, as Jensen has argued, the result of a genetic limitation.

Cued Recall

It has been found that frequently when material is not accessible at the time of output, the fault lies in the retrieval mechanisms (Tulving & Pearlstone,1966). Items may have been encoded in conceptual groups (no production deficiency), but the encoded organization has not been effectively utilized in retrieval. Cued recall is a technique for tapping organization that is being hidden by retrieval difficulties.

Tulving and Pearlstone (1966) found that the simple process of providing the subject with a retrieval cue elicited items which although not otherwise "accessible", were clearly "available". Evidence suggests that there is a direct relationship between the way in which items are encoded at the time of input, and the specific cues that will mediate retrieval at the time of output (Thomson & Tulving, 1970; Tulving & Osler, 1968). In one study, Thomson and Tulving (1970) were interested in determining whether a pre-experimental association between a to-be- remembered (TBR) word and a retrieval cue was a sufficient condition for the cue to elicit the TBR word at the time of recall, or whether the effectiveness of the cue depended on its having been encoded together with the TBR word, regardless of pre-experimental association. At the time of presentation each TBR word was accompanied by a weakly associated cue word. It was found that recall was facilitated by the presentation of these same weakly associated cues at the time of retrieval, but was no different from non-cued recall, when words considered to be strong pre-experimental associates of the TBR words, but which had not been presented during the input phase, were employed as retrieval cues. This relationship between encoding and retrieval is referred to by Tulving and Osler (1968) as the "encoding specificity hypothesis" according to which "specific retrieval cues facilitate recall if and only if the information about them and about the TBR word is stored at the same time as the information about membership of the TBR words in a given list (p. 593)."

If cues along a given dimension do elicit items that are not accessible in free recall, this provides evidence that the items were in fact organized along that dimension, or in other words that there was no production deffciency. Rather, the failure to recall the items without such cues suggests that the subject was unable to make use of his encoded organization at the time of retrieval. In the present study a cued recall task was included after free recall for the purpose of detecting whether any apparent failure to organize was due to encoding or retrieval difficulties.

Statement of the Problem

Rather than accepting the inevitability of Level II deficits in low SES children, the present study was based on the assumption that if such deficits can be traced to their source, effective remedies may follow. A number of questions were investigated with kindergarten and second-grade children of low and middle SES. These grade levels were chosen since the existing literature suggested that this was the transitional phase between colour and function preference, and hence the effects of differences in dimension preference on organization and learning could be examined. The specific questions under examination were as follows:

1. Do different groups of children attend to different dimensions of common objects around them? Specifically, when the function and colour of objects are competing dimensions, is function more salient for some groups of children and colour more salient for others? Are children more likely to classify information on the basis of a preferred rather than a non-preferred

dimension?

2. If groups of children can be differentiated on the basis of dimension preference, how do such differences relate to recall and clustering performance in a free recall task?

3. How are recall and clustering affected by instructions that subjects organize information on the basis of a preferred versus a non-preferred dimension?

4. Do recall tasks reveal differences in performance for children of different ages and SES levels? If performance differences indicate Level II deficits, do these reflect encoding difficulties, retrieval difficulties or both?

To investigate these questions, the present study used a modified version of the procedure of Moely et al (1969) with the additions of a test for preference before recall, and a cued recall task after free recall to tap any retrieval difficulties. There were three training groups: one instructed to organize along the preferred dimension, another along the non-preferred dimension, and a third receiving neutral instructions. Free recall performance was assessed over two trials. The procedure of Moely et al had to be modified somewhat because they had failed to equalize the time spent with the stimulus materials and the experimenter by the children in their training and control conditions, an oversight which makes the interpretation of their data somewhat ambiguous. In the present study, care was taken to assure that contact with the experimenter and the materials during training was the same for children in all conditions.

To the author's knowledge, the notion of dimension preference had never previously been considered as a variable that might affect the manifestation of conceptual abilities in low SES children. Such relevant literature as was available suggested that low SES children might benefit from a learning task which emphasized conceptual organization along a preferred dimension. However, with the little existing evidence, it was not known whether the particular dimensions being compared would turn out to be critical ones. The research process was, of necessity, one of exploration in a relatively unmapped area.

One of the major problems of experimental studies with low SES children is the difficulty of obtaining a measure of performance that is a true reflection of ability. Potentially interfering influences such as unfamiliarity with the stimulus materials, hostility towards an experimenter of different ethnicity, and general lack of motivation have artificially depressed the performance of the low SES child in a variety of experimental settings (Cazden, 1968; Cole, Gay, Glick & Sharp, 1971; Labov, 1970). In an attempt to control for such factors, the present experimental procedure was first tested with pilot subjects of both low and middle SES. Generally speaking, all children recognized and could label the stimulus pictures, and all responded positively to the task. Although the two experimenters were white as were all the children, it could be argued that the middle SES of the experimenters may have somewhat inhibited the performance of low SES children.

It should be emphasized that the prime objective of this study was not so much to attempt to equalize the performance of low and middle

SES children with one short training session, but rather to explore the possible sources of any Level II deficits.

METHOD

Subjects and Experimenters

The subjects were 72 children drawn from three schools in a low SES area, and 72 children from two schools in a middle SES area. An additional 11 low SES children and 7 middle SES children were excluded from the study because they had no clearcut preference for either colour or function (fewer than eight out of ten choices on the preferred dimension) or because of subnormal digit span (a scaled score of less than 10) as measured by the WISC (Wechsler, 1949) digit span test. All schools were under the jurisdiction of the English language sector of the Montreal Catholic School Commission. In addition to school zone, SES of all children was established on the basis of the father's occupation as rated by the Blishen Scale (1958). The occupations of fathers of middle SES children fell into the first and second classes of the seven-point scale, while those of low SES children either fell into the sixth and seventh classes or, being listed as "unemployed" or "welfare", were rated as class seven, since no further information was available. Within each SES class, 36 children were in kindergarten (mean age-five years seven months) and 36 were in grade two (mean age-seven years eight months). Kindergarten subjects will henceforth be referred to as five-year olds; second-grade subjects as seven-year olds. The distribution of boys and girls within each SES by Age group was as follows:

low SES five-year olds: 19 girls, 17 boys; low SES seven-year olds: 19 girls, 17 boys; middle SES five-year olds: 17 girls, 19 boys; middle SES seven-year olds: 16 girls, 20 boys. No further reference will be made to male-female differences as sex was not considered as a variable in this study. All children were white and English speaking.

The experimenters, both English speaking, white femalesof middle SES, each tested 72 subjects, with testing being counterbalanced across age, SES and instruction conditions.

Materials

Materials for the preference test were contained in a plain 10" by 12" loose-leaf binder. For each of the preference trials there were three pictures, mounted next to each other, half an inch apart, on an 8½" by 11" sheet of black construction paper. Each picture, presented vertically on a 3" by 5" white index card, was first outlined in india ink, then filled in with a solid colour by means of felt pen. A transparent plastic cover made to fit into the loose-leaf binder protected each page. To eliminate the possible influence of adjacency or spatial orientation on dimension preference, the pictures were arranged to obtain an approximately equal number of adjacent colour and function items throughout the ten trials. Left and right positions of adjacent colour and function items were similarly equated. There were a total of seven adjacent colour pictures and six adjacent function pictures. To avoid the possibility of a preference set based on adjacency or left-right position occuring in the first preference trial, the ten stimulus pages were arranged into four different orders, each order being equally distributed through all SES by Age groups. A description of each of the pictures used in the preference test appears in Appendix I.

For the recall tasks, materials consisted of 16 pictures of common objects, each picture belonging to one of four colour categories and one of four function categories, as shown in Table I. The colour categories consisted of brown, orange, white, and green, while the function categories consisted of animals, vegetables we eat, drinks, and growing things. Every effort was made to use colours intrinsic to each object (e.g. white milk) so that the association of an object to its function and colour dimensions would be as equivalent as possible. Preliminary pilot testing with the preference and recall test materials (done with low and middle SES children) indicated that in general all stimulus pictures were familiar to and could be labelled by pilot subjects, that the children showed no tendency to confuse the "vegetables-we-eat" and "growing things" categories, and that 16 items appeared to be an optimum list length, not overwhelming the younger subjects, and avoiding a ceiling effect with the older ones.

The stimulus pictures were first outlined in india ink, and then coloured in with water colours and Prismacolour pencil crayons. All pictures were presented horizontally on 3" by 5" white index cards, each picture appearing against a blue background to ensure sufficient colour contrast for all four colour categories. A well-fitting transparent envelope encased each picture to facilitate handling.

The WISC (Wechsler, 1949) forward and backward digit span test was used to test basic memory span.

TABLE I

SIXTEEN STIMULUS PICTURES USED FOR RECALL

	BROWN	ORANGE	WHITE	GREEN
animals	dog	rooster	rabbit	frog
vegetables-we-eat:	potato	carrot	onion	peas
drinks:	coke	orange jui[illegible]	milk	7-up
growing things:	tree trunk	autumn leaf	daisy	grass

Procedure

The subjects were all tested individually in a spare room in the school. Upon entering the room, the subject was asked to sit at a table, on a chair next to that of the experimenter. Before beginning the experimental procedure, a few minutes were allotted to "chatting" with the subject to reduce any possible anxiety. The procedure was carried out in four stages: a) a pretest to determine dimension preference, b) a period during which subjects were familiarized with the to-be remembered stimulus pictures and were given the appropriate instructions, c) two study periods and free recall trials, and d) a cued recall trial (see Appendix B).

Preference test. The preference test was then introduced, the experimenter saying: "We are now going to look at some nice pictures in this book I have in front of me." The four different orders for the preference trials were systematically counterbalanced across subjects in each Age by SES group. The experimenter presented the three stimulus pictures on the first page (Trial 1) to the subject, saying: "Show me which two of these pictures go together." The preference for Trial 1 was recorded, and the same procedure repeated for all nine subsequent trials. The experimenter offered no other comments throughout the preference test. Children who gave eight or more out of ten choices along their preferred dimension were classified appropriately as colour or function preferrers; the others were classified as having mixed preferences and did not participate further in the study.

The experimenter next introduced the digit span test saying: "We are now going to play a game with numbers." The forward and backward digit span test was then administered according to instructions in the WISC manual (Wechsler, 1949). Children with subnormal digit span were eliminated from the study. Regardless of performance, children received positive reinforcement in the form of general approval throughout all phases of the experiment in which they participated.

After the child had been classified as to preference and had passed the digit span test, he was assigned to one of the instruction groups, this assignment being such that the ratio of colour to function preferrers was approximately the same for the three instruction groups within each Age by SES classification as indicated in Table 2.

Familiarization with stimulus items. After the completion of preference testing, the experimenter exposed the 16 to-be- remembered stimulus pictures, which had been shuffled, laid out in a four by four array, and covered with a cloth before the subject's entry into the experimental room. The subject was asked to identify each picture in reading order. In the few cases that the subject was unable to name a picture or colour, the experimenter provided the label, asked the subject to repeat it, and made certain he could readily identify the item before proceeding to the instruction phase. If any of the labels provided by the subject were different from those which had been preassigned by the experimenter, but were nevertheless reasonably appropriate (e.g., "pepsi" for "coke", "cock-a-doodle-doo" for "rooster", "beans" for "peas"), they were considered correct and were accepted in recall. After all the stimulus items had been acceptably identified, the experimenter quickly collected the pictures, shuffled them, then let them fall in a loose pile

TABLE 2

EXPERIMENTAL DESIGN

AGE	SES	PREFERENCE	INSTRUCTION CONDITION		
			Control	Preferred	Non-preferred
5	Low	Colour	6[1]	5	5
		Function	6	7	7
5	Middle	Colour	3	3	4
		Function	9	9	8
7	Low	Colour	2	2	1
		Function	10	10	11
7	Middle	Colour	1	1	0
		Function	11	11	12

[1]The numeral indicates the number of subjects in the group.

on the table.

Instructions. The experimenter introduced the instruction phase by saying: "Soon we're going to play a memory game. In a few minutes I'll give you a chance to look at these pictures and learn them." Up to this point in the study, a common procedure was used for all subjects.

Control subjects were then asked to select pictures of their own choice, one at a time, and lay them out in columns of four from top to bottom, and from left to right until all pictures were entered into a four by four array. Although no restrictions were placed, no control subjects spontaneously organized by colour or function. The subject was required to identify each picture as he placed it, and then to count the number of columns as well as the number of items in each column.

The subjects in the preferred group were told to arrange items by colour, e.g. all white objects, if they were colour preferrers or by function, e.g. all animals, if they were function preferrers. Specifically, colour preferrers were instructed to form a four by four array, selecting pictures on the basis of a particular colour category for each column. Function preferrers proceeded in a similar fashion except for instructions to construct each column along a specific function category. Within each category the subject was free to select items in any order. Both colour and function preferrers were required to label pictures much the same as were control subjects. Upon completion of the four by four array, colour preferrers were instructed to count the number of colour categories as well as the number of instances in each category, while function preferrers were given the same instructions for the function dimension. The subjects were told that this information would be helpful during recall.

The subjects in the non-preferred group received the same instructions as those in the preferred group except that colour preferrers were instructed to organize the pictures along the function dimension, while function preferrers were instructed to organize along the colour dimension. The procedure for the remainder of the experiment was similar for all instruction conditions.

Study periods and free recall trials. The experimenter collected all the cards, shuffled them, and again lay them out randomly in a four by four array while giving the following instructions:

> O.K., now I'm going to give you a chance to spend a few minutes looking at these pictures. Look at them really hard, and try to learn them so that later when I take the pictures away, you'll be able to remember as many as possible.

Subjects were told that during the study period they could move the pictures around any way they wished to. The experimenter then moved her chair a few feet from the subject and attended quietly to paper work for the 90 second duration of the study period. If the subject attempted to engage the experimenter in conversation during the study period, she pointed out to him that she was occupied and would attend to him soon.

At the end of 90 seconds, the cards were quickly collected by the experimenter and placed face down in a pile on the table. The subject was then requested to name all the pictures he could remember. The recall period was considered to be over any time that the subject wished to terminate it between the end of the first and second minute. The subject was positively reinforced for each response, and if he indicated he could remember no more items before the end of the first minute, he was encouraged to make further attempts. No additional words were accepted after the end of the second minute.

Upon completion of the first trial, all subjects were commended on their performance and were encouraged to remember "even more" on the second trial. The experimenter again shuffled the cards and laid them out as before, and the second study period and free recall trial proceeded as the first.

Cued recall. Immediately after termination of the second free recall trial, function cues were supplied to subjects in all conditions in a constant, predetermined order. The following is an example of cue phrasing as used for the animal category: "Now, tell me what animal pictures you can remember." Parallel cues were employed for the three other function categories.

The duration of the complete procedure was approximately 20 minutes.

Data

Five different measures were obtained for each subject: number of choices on each dimension in the preference task, number of correct responses in free recall, clustering of items in both the colour and the function categories in free recall, and number of correct responses in cued recall.

A problem arose regarding the measure to be adopted as best general indicator of organization, as each subject had separate scores for colour and function clustering. Since subjects had a general tendency to cluster primarily along one dimension, the higher of the two cluster measures was selected as the best estimate of organization for each subject, and henceforth will be referred to as the measure of "primary clustering".

As the primary clustering measure for each subject could represent organization along either the function or colour dimension, interpretation of the relationship between the dimension of primary clustering and the instructed dimension was ambiguous. To resolve this difficulty, a second measure of organization was derived for each subject by taking the difference score between clustering along the instructed and uninstructed dimensions. Analysis of this measure of organization essentially yielded an index of the magnitude of compliance with the organizational instructions since, where effects for differences between instructed and uninstructed clustering were found to be similar to those for the primary clustering measure, the logical conclusion could be drawn that the instructed dimension was also the dimension of primary organization.

The measure used to derive both colour and function clustering scores for each subject was the modified ratio of repetition (MRR). This index, devised by Lesgold and Tieman (Bower, Lesgold & Tieman, 1969) is a modified version of Bousfield's (1953) original ration of repetition index. Clustering values can vary from a minimum of .00 when there is no consecutive repetition of items from the same category, to 1.00 when consecutive repetition of items from the same category is at a maximum. The MRR index is calculated by the formula $\underline{r}/\underline{n}-\underline{k}$, where $\underline{r}$ is equal to the number of clustered pairs, $\underline{n}$ is the total number of items recalled, and k, the number of categories represented in the recall list. Since the MRR index is a ratio of the amount of clustering observed to the amount possible, given the number of words recalled and the number of categories represented in recall, the measure can be misleadingly high when only a few items have been recalled. As an extreme example, if only two items are recalled, both from the same category, MRR equals 1.00. This peculiarity of measurement accounts for perplexingly high clustering obtained by some five-year old subjects with low recall scores. In spite of this failing (which appears to be a characteristic of clustering indices in general) MRR was considered to be the most appropriate index for this study, since it is the same as the clustering measure employed by Moely et al. (1969) in their study.

RESULTS

Preferences

Table 3 shows the distribution of function and colour preferences for the four Age by SES groups. A test for the difference between two proportions yielded a significant difference (z=3.62, $p < .01$) between five- and seven-year old subjects with more seven-year olds than five-year olds showing function preferences. The almost unanimous preference for function over colour among seven-year old subjects of both SES levels made statistical analysis superfluous. Among the five-year olds, although more middle SES subjects than low SES subjects selected function, the difference between the two SES levels was not statistically significant (z=1.45, $p > .05$).

Table 3

DISTRIBUTION OF COLOUR AND FUNCTION PREFERENCES IN RELATION TO AGE AND SES

	AGE AND PREFERENCE			
	5-Year Olds		7-Year Olds	
	Colour	Function	Colour	Function
Low SES	16	20	5	31
Middle SES	10	26	2	34
Total	26	46	7	65

Free Recall: Correct Responses

Correct resposes as a function of age, SES, instruction condition, and trials. The analysis of correct responses as a function of age, SES, instruction condition, and trials is presented in Table A, of Appendix III, while the means for these variables are shown graphically in Fig. 1. Significant main effects were found for age, $F(1,132)=37.80$, $p < .01$, with seven-year old subjects remembering more items than five-year olds, and for trials, $F(1,132)=18.68$, $p < .01$, with recall being generally greater for Trial 2 than for Trial 1. Neither SES nor instruction condition proved to have significant main effects. The effect of trials varied with age and with SES, as indicated by the significant Age by Trials, $F(1,132)=6.28$, $p < .05$, and SES by Trials, $F(1,132)=9.68$, $p < .01$, interactions. Post hoc comparisons using Ciccetti's (1972) modification of the Tukey(a) procedure (Winer, 1962) showed a significant improvement ($p < .01$) from Trial 1 to Trial 2 for seven-year old subjects, but not for five-year olds, and also a significant improvement ($p < .01$) from Trials 1 to 2 for middle SES subjects, but not for those of low SES.

In addition to these effects there was a significant Age by SES by Instruction Condition interaction, $F(2,132)=3.13$, $p < .05$, which reflected the greater influence of the instruction variable over middle SES than over low SES subjects, as well as differences in relative effectiveness of the three instructions for the two groups of middle SES subjects. The nature of this interaction can be seen clearly by inspection of Fig. 2.

Correct responses in relation to initial preference and actual instructions. While the principal analysis supplied information on the

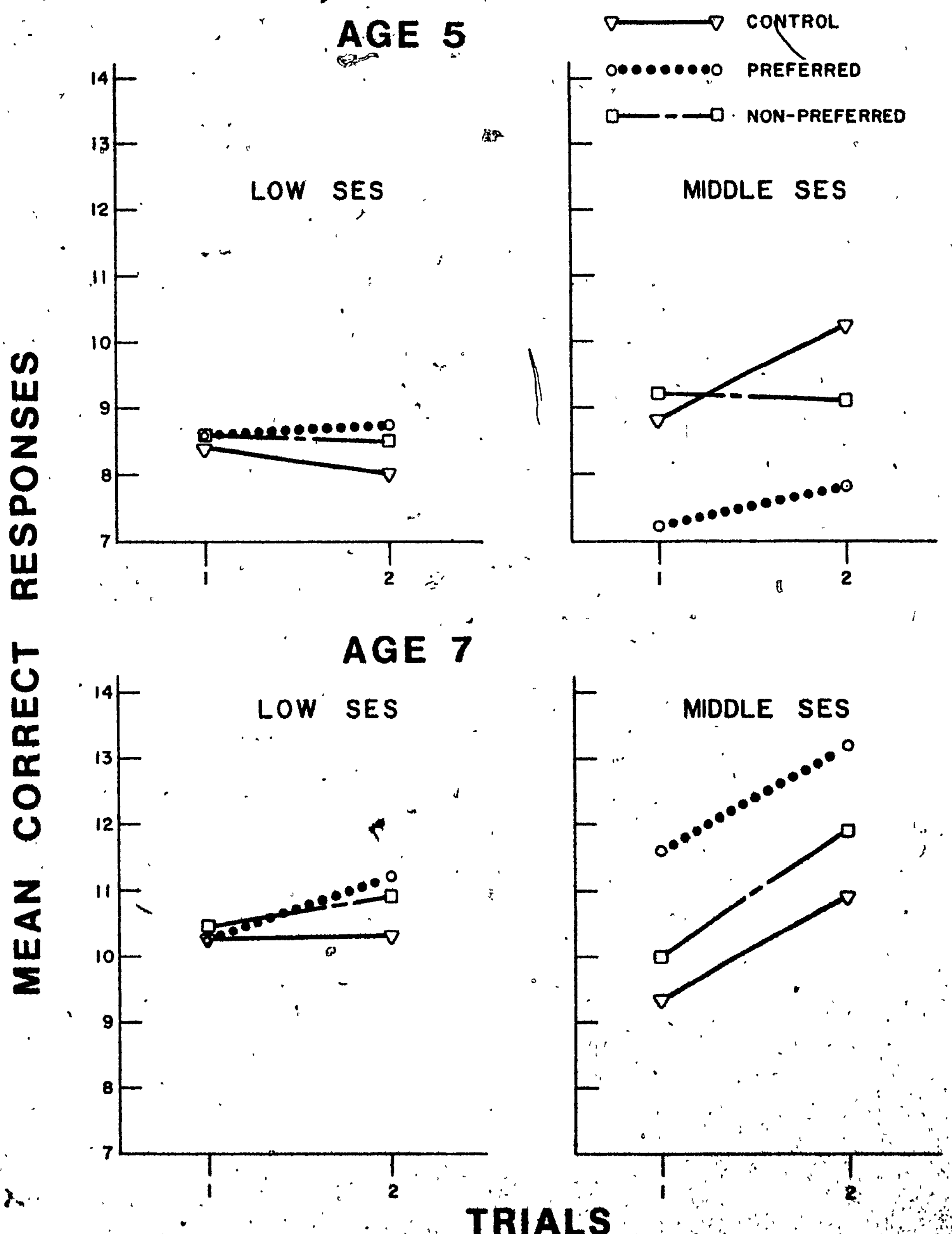

Fig 1. Mean number of correct responses as a function of age, SES, instruction condition, and trials.

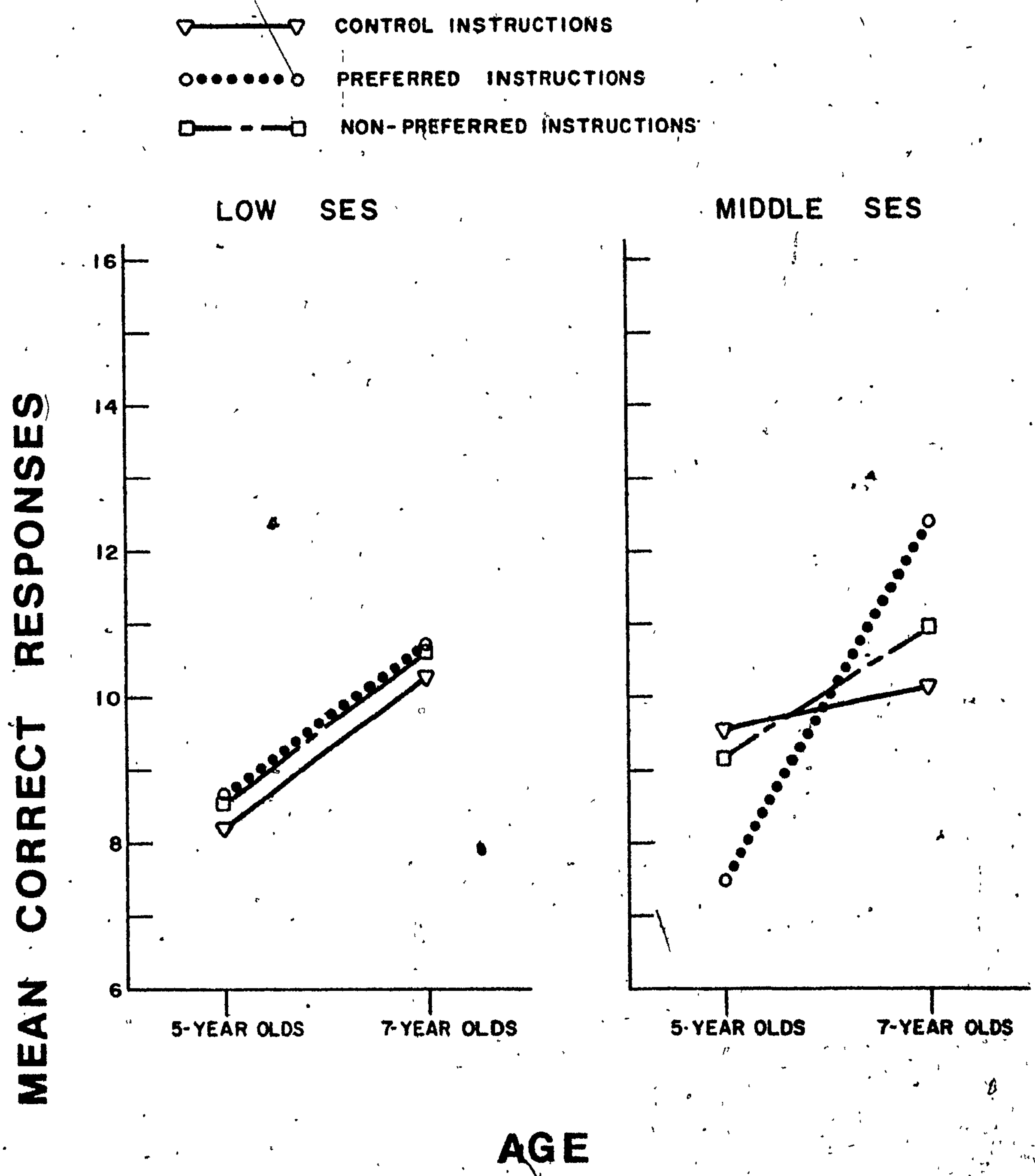

Fig. 2 Mean correct responses for instruction condition as a function of age and SES.

effects of preferred and non-preferred instructions on free recall in relation to age and SES, it provided no indication of the influence of subjects' initial preference or of the relative effectiveness of colour and function instructions. Subsidiary analyses were therefore performed to examine the effects of these additional variables. The term "actual instructions" (as distinguished from "instruction conditions") is employed to designate control, colour and function instructions in these subsidiary analyses.

Because the distributions of colour and function preferrers were very different for the two age groups, the data for five- and seven-year old subjects were analyzed separately. Actual instruction effects, as well as the influence of differences in initial preference on recall performance were analyzed for the five-year olds since both colour and function preferences were substantially represented in this age group. Since grouping the five-year olds by preference resulted in highly unequal numbers of subjects under the different conditions, Mann-Whitney U tests (or the normal approximation when the sample size was sufficiently large, c.f. Siegel, 1956) were used for the subsidiary analyses with this age group. With the seven-year olds, there were so few colour preferrers that the effects of initial preference could not be meaningfully analyzed. Instead the data from the seven subjects showing colour preferences were eliminated, and two by three analyses of variance (SES by Actual Instructions) with unequal ns, were performed separately for Trials 1 and 2 on the data from function — preferring subjects only. Performance on the two trials was analyzed separately in order to parallel the analyses for five-year olds.

1. Five-year olds: Correct responses in relation to initial preference and actual instructions. The data for the subsidiary analyses for five-year old children are summarized in Table B of Appendix III. Function preferrers remembered more items than did colour preferrers, although the difference was significant only on Trial 2, (Z=1.97, $p < .05$). There were no significant differences in correct recall as a function of SES for either colour or function preferrers.

A comparison of the amounts recalled by subjects receiving colour and function instructions yielded no significant overall differences. When the effects of actual instructions in relation to initial preference were assessed, no significant differences in recall were found.

2. Seven-year olds: Correct responses in relation to actual instructions. As can be seen from the mean values in Table 4 and the summaries of the analyses of the Trial 1 and Trial 2 data in Table C of Appendix III, actual instructions had a significant effect on Trial 2, $F(2,59)=4.39$, $p < .05$, with post hoc Tukey(a) tests indicating that function instructions produced significantly greater ($p < .05$) recall than did neutral instructions. Recall for function instructions was also greater than it was for colour instructions, although not significantly so. On Trial 1 similar trends were observed, but differences were not significant. Middle SES subjects performed significantly better on Trial 2 than did low SES subjects, $F(1,59)=5.82$, $p < .05$, but the performance of the two groups was virtually identical for Trial 1. This discrepancy between Trial 1 and Trial 2 corresponds to the already reported Trials by SES interaction for all subjects, suggesting possibly a general decrease in attention from Trial 1 to Trial 2 for low SES subjects.

TABLE 4

MEAN FREE RECALL SCORES FOR 7-YEAR OLD FUNCTION PREFERRERS AS A FUNCTION OF SES, AND ACTUAL INSTRUCTION ON TRIALS 1 AND 2

		INSTRUCTIONS		
Trials		Neutral Instr.	Colour Instr.	Func. Instr.
1	Low SES	10.20	10.55	10.60
	Middle SES	9.45	10.00	12.00
	Mean[a]	9.82	10.27	11.30
2	Low SES	9.30	10.90	11.60
	Middle SES	11.11	11.92	13.56
	Mean	10.20	11.41	12.57

[a] Grand means not connected by a common line differ significantly ($p < .05$).

Free Recall: Clustering

Table 5 provides a summary of the frequency of primary clustering along the function dimension in relation to age, SES, instruction condition and actual instructions for Trials 1 and 2. The predominance of function clustering, especially for neutral and function instructions is apparent for subjects of both age groups and SES levels.

Primary clustering as a function of age, SES, instruction condition, and trials. As can be seen from Table D, of Appendix III, the analysis of primary clustering as a function of age, SES, instruction condition and trials indicated that primary clustering was greater for middle than for low SES subjects, $F(1,132)=8.43$, $p < .01$, and that it differed significantly across instruction conditions, $F(2,132)=5.14$, $p < .01$, being greater with preferred instructions than with either neutral or non-preferred instructions, with post hoc analyses using the Tukey(a) procedure showing a significant difference ($p < .05$) between preferred and neutral instructions. The means for these effects are presented in Table 6. Neither age nor trials significantly affected primary clustering, nor were there any significant interactions.

As shown in Table E of Appendix III, a second analysis was performed, this time examining the effects of age, SES, two instruction conditions (preferred and non-preferred), and trials on the difference between instructed and uninstructed clustering. This analysis provided a way of measuring compliance with instructions under the different experimental conditions. There was a significant effect of instruction conditions, $F(1,88)=7.94$, $p < .01$, with more compliance present for preferred than for

TABLE 5

RELATIVE FREQUENCY OF SUBJECTS SHOWING PRIMARY CLUSTERING ALONG THE FUNCTION DIMENSION IN RELATION TO AGE, SES, INSTRUCTION CONDITION, AND ACTUAL INSTRUCTIONS ON TRIALS 1 AND 2

			5-year Olds		7-Year Olds	
			Low SES	Middle SES	Low SES	Middle SES
Trial 1	Control	-	.83(12)[a]	.75(12)	.92(12)	83(12)
	Preferred:	Function Instr.	1.00(7)	.89(9)	1.00(10)	.99(11)
		Colour Instr.	1.00(5)	.67(3)	.00(2)	1.00(1)
	Non-Preferred:	Function Instr.	.80(5)	.75(4)	1.00(1)	-
		Colour Instr.	.66(7)	.00(8)	.82(11)	.17(12)
Trial 2	Control	-	.75(12)	.83(12)	.75(12)	.75(12)
	Preferred:	Function Instr.	1.00(7)	.89(9)	.90(10)	.99(11)
		Colour Instr.	.20(5)	.67(3)	1.00(2)	1.00(1)
	Non-Preferred:	Function Instr.	.80(5)	.75(4)	1.00(1)	-
		Colour Instr.	.43(7)	.50(8)	.73(11)	.42(12)

[a]The number in brackets refers to the number of subjects on which the relative frequency is based.

TABLE 6

MEAN CLUSTERING SCORES AS A FUNCTION
OF SES AND INSTRUCTION CONDITION
FOR ALL SUBJECTS

	Control	Preferred	Non-Preferred	Mean
Low SES	.534	.638	.645	.605
Middle SES	.650	.802	.648	.700
Mean*	$.592_{a}$	$.720_{b}$	$.647_{ab}$	

* Grand means not subscripted by a common letter differ significantly, ($p < .05$).

non-preferred instructions. Since preferred instructions also resulted in greater primary clustering scores (see Table D of Appendix III), it can be inferred that subjects receiving preferred instructions were more likely to organize items as instructed, and to show a greater magnitude of organization as measured by primary clustering scores. Although the SES effect did not quite attain significance, it merits mentioning in that the greater compliance to any instructions by middle SES subjects over low SES subjects reflects a theme recurring a number of times through the data. The triple interaction between trials, age, and instructions, $\underline{F}(1,88)=5.53$, $\underline{p}<.05$, depicted in Fig. 3 shows that on Trial 1, seven-year old subjects obeyed preferred instructions more than five-year olds and non-preferred instructions less than five-year olds, and that a similar pattern was observed on Trial 2 with differences considerably reduced.

Clustering in relation to initial preference and actual instructions. For five-year old subjects, analyses were performed on the primary clustering measure as in the principal analysis. With seven-year old function preferring subjects, both colour and function clustering measures were analyzed, since dimensional clustering could be assessed in relation to actual instructions while holding initial preference constant.

1. Five-year olds: Primary clustering in relation to initial preference and actual instructions. The data for the subsidiary analyses on higher clustering for five-year old subjects are presented in Table F of Appendix III. Mann-Whitney U tests showed that there were no overall significant differences in primary clustering between colour and function

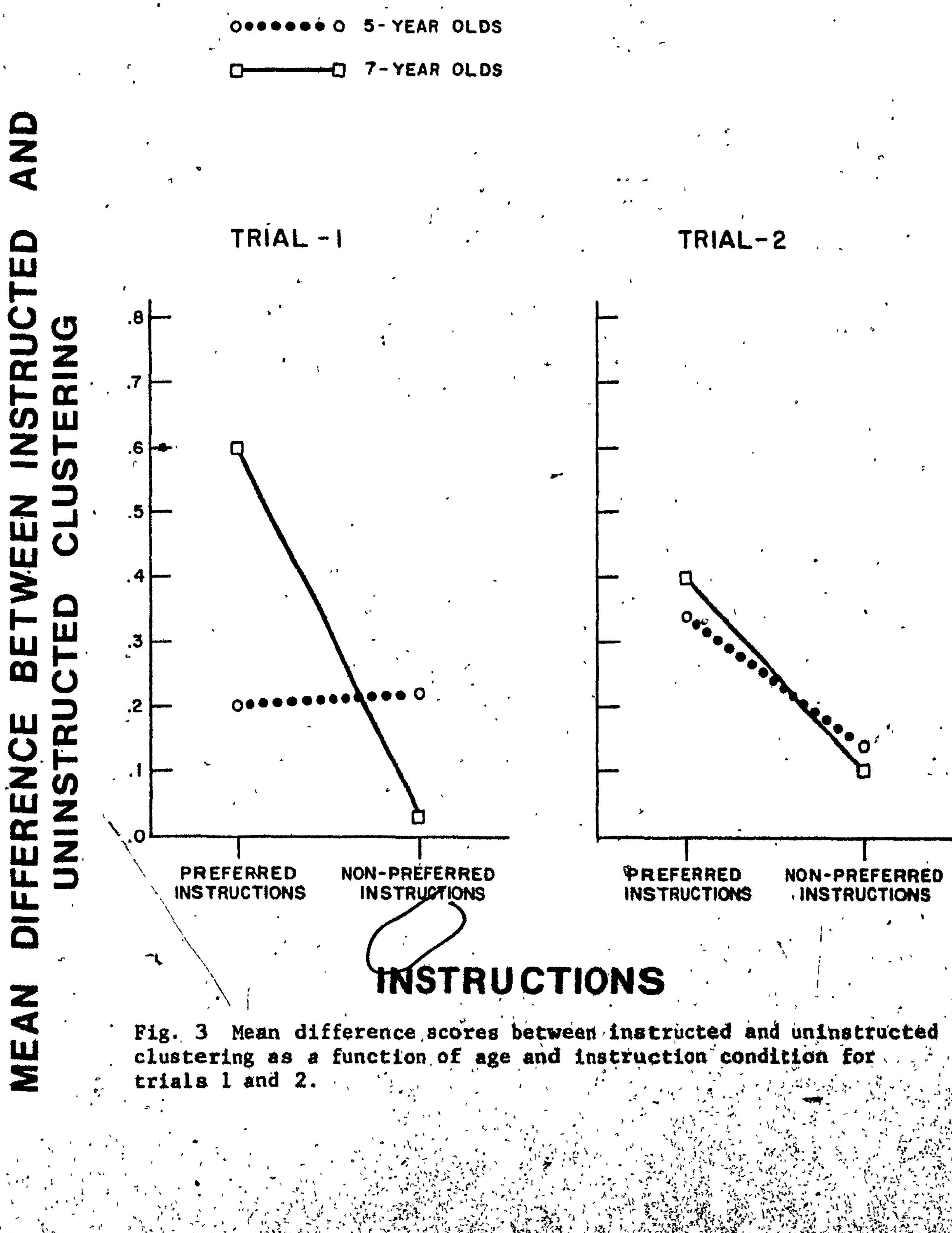

Fig. 3 Mean difference scores between instructed and uninstructed clustering as a function of age and instruction condition for trials 1 and 2.

preferrers. Primary clustering for middle SES colour preferrers was generally greater than for low SES colour preferrers, with differences attaining significance on Trial 2, U(10,16)=18, $p < .05$. No SES differences in primary clustering were observed for function preferrers.

There was no significant overall difference in primary clustering between function and colour instructions. When the data were examined for relations between actual instructions and initial preference, function preferrers were found to profit more from function than from colour instructions, although the difference was significant only on Trial 1, U(15,16)=42, $p < .05$. There were no significant differences in primary clustering between colour and function instructions for colour preferrers.

When the difference scores between instructed and uninstructed clustering were analyzed in relation to preference and actual instructions, by Mann-Whitney U tests, it was found that both colour and function preferrers generally obeyed function instructions more than colour instructions, with all comparisons being statistically significant ($p < .05$) except for colour preferrers on Trial 2.

2. Seven-year olds: Dimensional clustering in relation to actual instructions. Tables G and H in Appendix III summarize the data for the analyses of variance of colour and function clustering for seven-year old function preferrers in relation to SES and actual instructions.

a) Colour clustering.- For colour clustering, there were significant actual instruction effects, $F(2,59)=12.12$, $p < .01$, $F(2,59)=7.31$, p $<$ .01, with Tukey(a) post hoc tests showing that colour instructions were significantly more effective ($p < .05$) than either neutral or function instructions on both trials. Subjects of middle SES generally obtained higher colour clustering scores than did those of low SES with differences attaining significance on Trial 1, $F(1,59)=5.21$, $p < .05$. These results appear to reflect a general tendency for middle SES subjects to comply with colour instructions and for low SES subjects to ignore them. This interpretation is buttressed by Tukey(a) post hoc comparisons performed on the significant SES by Actual Instruction interaction on Trial 2, $F(2,59)=4.01$, $p < .05$, which is depicted in Fig. 4. Post hoc tests on this interaction indicated that colour clustering was significantly ($p < .05$) greater for middle SES subjects given colour instructions that for middle SES subjects given function instructions or for low SES subjects regardless of instructions, and that there were no significant differences among these latter three conditions.

b) Function clustering.- Clustering along the function dimension differed significantly with actual instructions on both Trials, $F(2,59)=12.10$, $p < .01$, $F(2,59)=7.10$, $p < .01$. Function instructions elicited higher function clustering than did colour and neutral instructions, with post hoc Tukey(a) comparisons showing that this superiority was significant ($p < .05$) for both trials in comparison with colour instructions and for Trial 1 in comparison with neutral instructions. There was no significant difference in function clustering between SES groups, although the trend noted in Table H of Appendix III was in favour of low SES subjects.

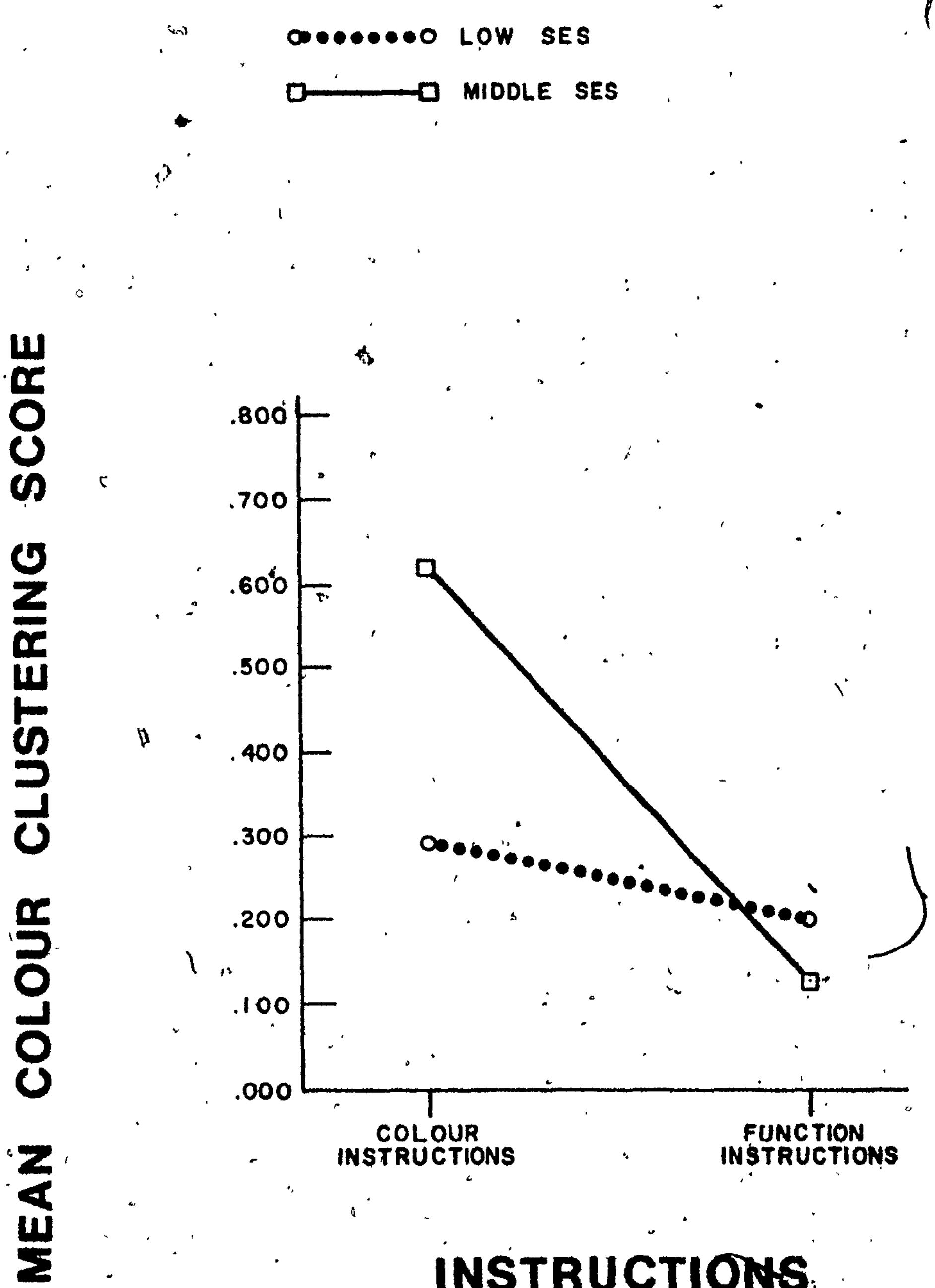

Fig. 4. Mean colour clustering scores as a function of of SES and actual instructions, for 7-year old function preferrers, Trial 2.

Post hoc Tukey(a) comparisons of the significant SES by Actual Instruction interactions found on both trials, $F(2,59)=4.94$, $p<.05$, $F(2,59)=6.96$, $p<.01$, as depicted in fig. 5, again confirmed that low SES subjects tend to ignore colour instructions in that on both trials the only significant effect was the drop in function clustering shown by middle SES subjects when they were given colour instructions.

Cued Recall

A chi-square analysis showed a general increase ($x^2=15.89$, $p<01$) in correct responses from free recall to cued recall for subjects of both age groups and SES levels.

Correct responses as a function of age, SES and instruction condition. As can be seen from the means in Table 7, and the summary of the analysis of variance of correct responses as a function of age, SES, and instruction condition in Table I of Appendix III, recall was significantly greater, for seven-year old children than for five-year olds in response to function cues, $F(1,132)=24.86$, $p<.01$. There were no other significant main effects or interactions. These effects are similar to those obtained in free recall.

In order to find out whether increases in correct responses from free recall to cued recall varied as a function of age, SES, and instruction condition, an analysis of variance was performed on the difference between mean free recall scores and cued recall scores. Table J of Appendix III shows that no significant effects were found which indicates that low SES subjects, despite their lower organization scores, benefitted just as much from function cues as did middle SES subjects.

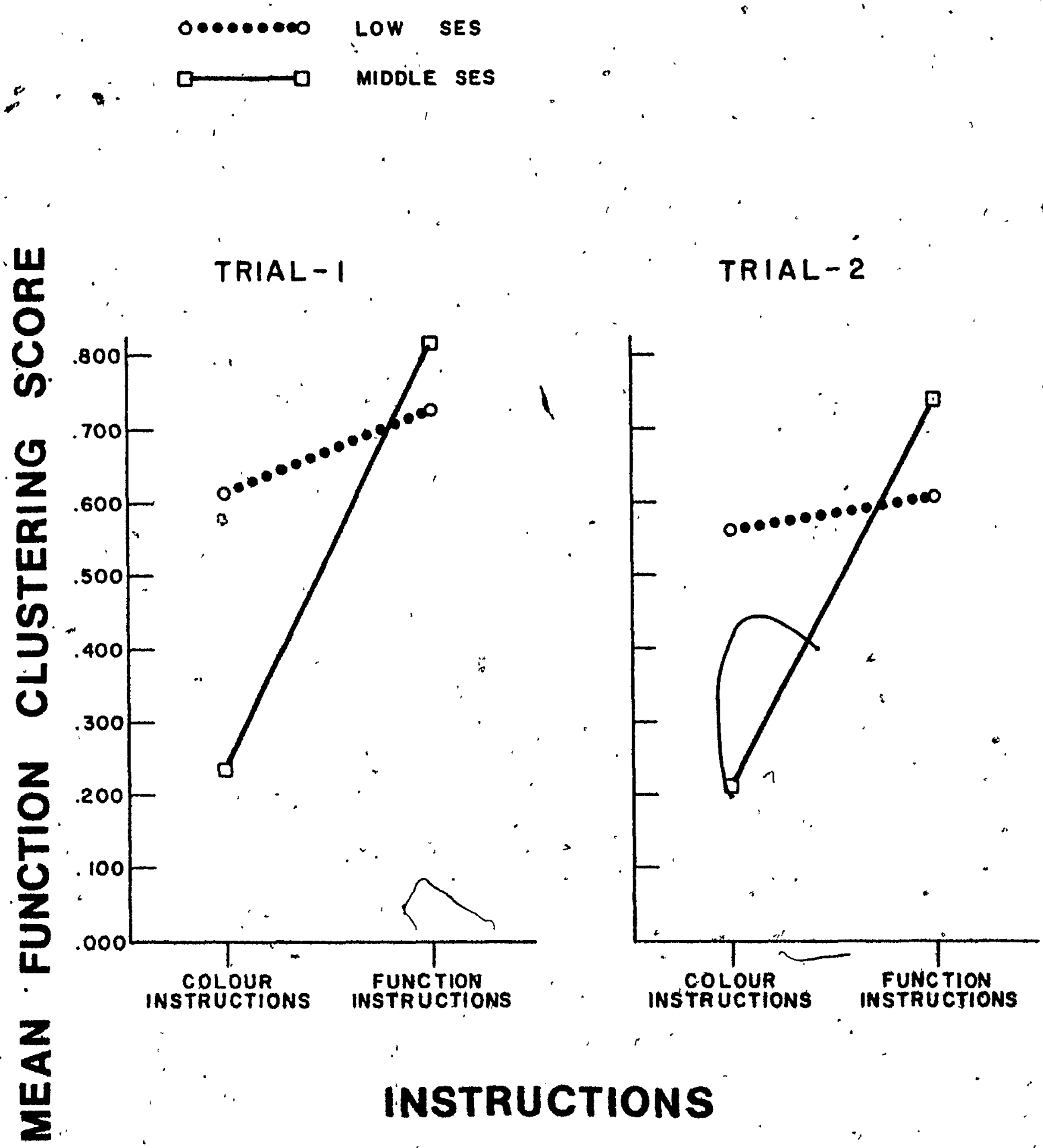

Fig. 5. Mean function clustering scores for 7-year old function preferrers as a function of actual instructions and SES on Trials 1 and 2.

TABLE 7

MEAN CUED RECALL SCORES AS A FUNCTION OF AGE, SES, AND INSTRUCTION CONDITION

	5-Year Olds		7-Year Olds		Mean
	Low SES	Middle SES	Low SES	Middle SES	
Control	10.00	10.42	12.08	11.76	11.07
Preferred	10.92	9.92	12.50	13.67	11.75
Non-Preferred	10.32	10.67	11.33	11.92	11.06
Mean	10.41	10.34	11.99	12.45	

Correct responses in relation to initial preference and actual instructions.

1. Five-year olds: Correct responses in relation to initial preference and actual instructions. As indicated in Table K of Appendix III, function preferrers attained significantly higher cued recall scores than did colour preferrers ($Z=2.29$, $p<.05$). No significant SES effects were found for either function or colour preferrers.

Cued recall was significantly greater for subjects who had received function instructions than for those who had received colour instructions before free recall, $U(23,25)=130, p<.05$.

When analyses were performed to test the effect of the relationship between initial preference and actual instructions, it was found that cueing resulted in significantly higher scores for both colour and function preferrers $U(8,9)=9$, $p<.05$; $U(15,16)=66$, $p<.05$, who had received function instructions before free recall as opposed to those who had received colour instructions.

2. Seven-year olds: Correct responses in relation to actual instructions. The summary of the analysis of variance of cued recall scores as a function of actual instructions and SES in Table L of Appendix III reveals an effect of actual instructions, $F(2,59)=4.65, p<.05$, with Tukey(a) post hoc analysis showing that function instructions resulted in significantly ($p<.01$) greater recall than colour instructions. No other effects were significant.

A question of interpretation arose from the repeated finding that cued recall was superior for subjects who had received function instructions. If function retrieval cues were really more effective for subjects who had received function instructions, the difference between cued recall scores and Trial 2 free recall scores should be greater for subjects who had received function instructions than for those who had received colour instructions. Mann-Whitney U tests revealed no significant overall effects of actual instructions for difference scores between Trial 2 and cued recall scores in five-year old subjects regardless of initial perference. Similarly, a t test on the difference scores for seven-year old function preferrers yielded no significant difference between colour and function instructions. These results suggest that the superior cued recall performance of subjects with function instructions was probably an extension of differences already existing at the end of free recall, and that function cues were not differentially effective for subjects receiving function and colour instructions.

DISCUSSION

The data will be discussed in relation to the following four points of interest: a) differences between age and SES groups in dimension preference, and the relationship between dimension preference and dimension of primary organization; b) effect of preferred versus non-perferred instructions; c) general effects of function versus colour classification, and d) performance comparisons of the age and SES groups on the recall tasks.

While significantly more seven- than five-year olds classified on the basis of function in the preference task, there were no significant differences in dimension preference between subjects of low and middle SES. This finding does not of course mean that children of the two SES groups perceive stimuli in the same way, but rather, that function and colour are not dimensions that distinguish the perception of middle and low SES children within the age range tested.

The data did not support the prediction that there would be a close relationship between the subject's preferred dimension and the dimension along which he would tend to cluster or organize information. Generally speaking, organization was predominantly by function, regardless of original preference. Of 48 control subjects receiving no organization instructions, only 5 clustered primarily by colour on Trial 1, and 6 on Trial 2. Of the 12 control subjects who were colour preferrers, only one organized by colour on Trial 1; none did on Trial 2.

There were two essential differences between preference and recall tasks which may account for this discrepancy between dimension preference and dimension of organization observed in colour preferring subjects. First of all, the two tasks differed in degree of complexity—the preference task involved recombination of three stimuli, whereas sixteen stimuli were used for the recall task. Secondly, the preference task was conducted with stimuli present; organization was manifested with stimuli absent.

By the time a child becomes capable of classifying items by function — and there is evidence that by age five even the child who prefers colour is aware of function categories (Birch&Bortner, 1966) — the association of an item may be stronger with its function category than with its colour category A particular instance of a function class is always a member of that class, regardless of perceptual changes and varying circumstances. Few instances are equally stable with respect to membership in a colour class. A rabbit is always an animal, but it is not always white. Therefore, once a child acquires function classification, a given item is likely to be associated more frequently with its function category than with its colour category, thereby creating a stronger bond between the item and its function class. Although in a simple task (three items) the earlier acquired colour dimension may still be more salient, it seems plausible that a child would utilize the dimension of greater associative strength for a more complex task (sixteen stimuli).

The other essential difference between preference and recall tasks was the perceptual availability of stimuli during preference selection, but not during recall. The encoding process is presumably multidimensional, but the different dimensions of a stimulus may be encoded with varying degrees of strength or efficiency. With stimuli available to perception as in the preference task, colour may be salient for the young child. However, with stimuli absent as in the free recall task, although encoding may have proceeded along a number of dimensions, organization or clustering may be manifested along the dimension encoded with the greatest strength or efficiency. Variables determining encoding strength or efficiency remain to be investigated, but it seems plausible that degree of pre-experimental association between an item and its category would be a relevant factor. Using colour as the retrieval cue on a cued recall trial would indicate whether encoding did take place along the colour dimension, although strength or efficiency of encoding would not be indicated.[1]

A major objective of the present study was to investigate the effects of incorporating a preferred dimension into a conceptual learning task. Although preferred instructions did in some cases facilitate performance, interpretation of the results is somewhat ambiguous since the high proportion of function preferrers produced a situation in which preferred instructions were predominantly function instructions. The data indicate that when superior performance was observed in response to preferred instructions, the effect was largely due to function instructions rather than to a positive relationship of instructions to dimension preference.

Generally speaking, use of the function dimension was associated with higher performance than was use of the colour dimension in all phases of this study. Superior recall performance corresponded to function preference (determinable for five-year old subjects only), to function instructions (for seven-year olds; general trend for five-year olds) and to organization of material by the subject along the function dimension (seven-year olds).

As predicted from the existing literature, seven-year old subjects remembered more items and improved more across trials than did five-year olds. The finding that magnitude of organization was not significantly

[1] It is suggested that the mechanism underlying the distinction between items "available" in response to retrieval cues but not "accessible" in free recall (Tulving & Pearlstone, 1966) is related to encoding strength or efficiency -- ie. retrieval cues may compensate for weak or inefficient encoding.

influenced by the age variable corresponds to the results of Moely et al (1969) who also found no age-dependent clustering differences either before or after training in children ranging from kindergarten to third grade. However, in view of the fact that Moely et al found increases in recall to be accompanied by increases in clustering, the failure of age to exert an influence on clustering in the presence of a significant effect on recall score is somewhat puzzling. This finding is however in agreement with Laurence (1966) who noted a similar discrepancy between recall and clustering in young children. The earlier-mentioned peculiarity of the MRR index may in part contribute to the no-difference finding as a number of primary clustering measures for five-year olds with low recall scores may be somewhat inflated. Probably also reflected is a developmental increment in memory span without concomitant increases in the use of organization.

There were no differences between the SES groups in the number of items recalled in the free recall task, but measures of organization were greater for middle SES subjects. The absence of recall differences together with the presence of organization differences may apper on first analysis to be consistent with Jensen's hypothesis of equal Level I ability for the two SES classes, and Level II deficits in low SES children. The plausibility of this interpretation rests on the assumption that recall scores (on which performance between the two groups was similar) reflect Level I ability, and organization (on which performance of middle SES subjects was greater) reflect primarily Level II ability.

However, in view of the fact that greater organization should produce greater recall, one is faced with the discrepancy between recall and organization data. If organization facilitates recall, then the equivalent low and middle SES recall scores are either the result of superior Level I ability in low SES children — which is contrary to Jensen's findings — or some excess, unexplained process compensating for Level II deficits in low SES children. Alternatively, middle SES children, for some unknown reason, may not have profited from their use of organization. It should be noted that although clustering measures were significantly greater for middle SES subjects ($\bar{X}$ MRR = .700) than for low SES subjects ($\bar{X}$ MRR = .605), clustering, and therefore use of Level II skills by low SES subjects was nevertheless substantial.

A second source of difficulty for Jensen's hypothesis was the absence of cued recall differences between the two SES groups. According to Tulving's encoding specificity hypothesis, a recall cue is effective at the time of retrieval only if it has been stored with the to-be-remembered word during encoding. It follows that although more spontaneous clustering was observed for middle SES subjects in free recall, the magnitude of organization (at least along the function dimension) was no different for low and middle SES subjects during encoding. This suggests that although low SES children may organize information conceptually for encoding, they may have difficulty in making use of conceptual schemes at retrieval. This raises some questions: Does availability of items in cued recall suggest that any retrieval difficulties in free recall are a function of problems occurring only at the time of retrieval? Alternatively, even though cued recall suggests that items have been encoded along a given dimension, could it be that any difficulties observed in retrieval are reflecting weak or inefficient encoding rather than simply retrieval problems?

Three lines of evidence suggest generally lower task orientation for low SES subjects, which may contribute to any performance differences between the two groups. First, the recall of low SES children did not improve across trials, while that of middle SES children did. Second, as indicated by the Age by SES by Instruction Condition interaction on correct responses in free recall, low SES subjects showed little response to the difference in instructions while performance of middle SES subjects showed a substantial instruction condition effect. Third, the apparent selective compliance with function instructions by low SES children can be interpreted as general inattentiveness to organization instructions. In view of the fact that most control subjects used function clustering, the predominant use of function clustering by low SES subjects, regardless of instructed dimension, suggests that they were not selectively complying with function instructions, but were ignoring organization instructions altogether.

If such inattention to instructions characterizes the general response of low SES children in the classroom, it is not altogether surprising that they are suffering a deficit in the conceptual skills being taught. One is led to ask whether the low SES child is inattentive because, as Jensen would argue, his genetic limitations make him incapable of assimilating the conceptual processes being taught, or whether he is lagging behind in conceptual skills because he is inattentive for other reasons. In either case, unearthing the source of the difficulty may be a first step towards alleviating it.

Discovering whether the factors determining relatively poor performance in low SES children are primarily hereditary or environmental is much less important than determining under what conditions low SES children can learn conceptually. If the factors determining performance are primarily environmental, the solution is clearly to modify the environment. However, even if differences in performance can be traced to differences in heredity, the manifestation of a given genetic endownment emerges only out of interaction with a given environment. The implication here is that different learning environments may be required to maximize differing heredities. Hertzig, Birch, Thomas and Mendez (1968) cited a study in which Tryon (1940) selectively bred "maze-bright" and "maze-dull" rats. An enclosed alley-maze task was used to distinguish "bright" from "dull" animals. It was suggested by Hertzig et al that this particular task capitalized on the use of non-visual cues, to which the "bright" rats were particulary responsive. Their inference was that the rats had been specifically bred for responsiveness to non-visual cues and not for general brightness in maze learning. If this inference was valid, it should have been possible to alter the specific task without changing the basic maze-learning goal in such a way that the "dull" rats became "bright". Hertzig et al cited another study, Searle (1949), that supported this interpretation. In Searle's study the maze was elevated so that visual cues became the critical ones for learning. Under these conditions Tryon's "bright" rats had great difficulty learning, while the "dull" ones learned with great facility. The implications for learning in low SES children should be clear. All avenues must be explored to discover under <u>what conditions</u> low SES children will manifest Level II abilities before any consideration is given to the restrictive learning-by-rote education proposed by Jensen.

The present exploratory study generally represented a search for possible determinants of Level II deficits in low SES children that could be followed up further in analytical studies. The results of this study indicate that further investigation of the following topics may produce fruitful results: a) factors influencing attention to instructions and general task orientation in low SES children, b) differences in general perceptual orientation between low and middle SES children, when and how such differences originate, and how they might influence conceptual ability and performance, and c) specific sources of failure in encoding and/or retrieval processes that may lead to Level II deficits.

REFERENCES

Bernstein, B. Social structure, language and learning. Educational Research, 1961, 3 163-176.

Bernstein, B. Some sociological determinants of perception: An inquiry into subcultural differences. In J.A. Fischman (Ed.), Readings in the sociology of language. The Hague: Mouton & Co., 1968. Pp. 223-239.

Birch, H.G. and Bortner, M. Stimulus competition and category usage in normal children. Journal of Genetic Psychology, 1966, 109, 195-204.

Blishen, B.R. The construction and use of an occupational class scale. Canadian Journal of Economics and Political Science, 1958, 24, 453-458.

Bousfield, W.A. The occurrence of clustering in the recall of randomly arranged associates. Journal of Genetic Psychology, 1953, 49, 229-240.

Bousfield, W.A. and Cohen, B.H. The effects of reinforcement on the occurrence of clustering in the recall of randomly arranged associates. Journal of Psychology, 1953, 36, 67-81.

Bousfield, W.A., Esterson, J., and Whitmarsh, G.A. A study of developmental changes in conceptual and perceptual associative clustering. Journal of Genetic Psychology, 1958, 92, 95-102.

Bower, G.H., Lesgold, A.M. and Tieman, D. Grouping operations in free recall. Journal of Verbal Learning and Verbal Behaviour, 1969, 8, 481-493.

Brian, C.R. and Goodenough, F.L. The relative potency of colour and form perception at various ages. Journal of Experimental Psychology, 1929, 12, 197-213.

Cazden, C.B. Subcultural differences in child language — an inter-disciplinary review. In J. Hellmuth (Ed.), Disadvantaged Child, Vol. II. Washingtion: Special Child Publication Inc., 1968.

Cicchetti, D.V. Extension of multiple-range tests to interaction tables in the analysis of variance: A rapid approximate solution. Psychological Buletin, 1972, 77, 405-408.

Cole, M., Frankel, F. and Sharp, D. Development of free recall learning in children. Developmental Psychology, 1971, 4, 109-123.

Cole, M., Gay, J., Glick, G., and Sharp, D.W. The cultural context of learning and thinking. New York: Basic Books, 1971.

Corah, N. L. Colour and form in children's perceptual behaviour. Perceptual and Motor Skills, 1964, 18, 313-316.

Flavell, J.H., Beach, D.H., and Chinsky, J.M. Spontaneous verbal rehearsal in a memory task as a function of age. Child Development, 1966, 37, 283-299.

Glasman, L.D. Cited in A.R. Jensen, How much can we boost I.Q. and scholastic achievement? Harvard Educational Review, 1969, 39, 1-123.

Harris, L., Schaller, M.J. and Mitler, M.M. The effect of stimulus type on performance in a colour-form sorting task with preschool, kindergarten, first-grade and third-grade children. Child Development, 1970, 41, 177-191.

Hertzig, M.E., Birch, H.G., Thomas, A., and Mendez, G.A. Class and ethnic differences in the responsiveness of preschool children to cognitive demands. Monographs of the Society for Research in Child Development, 1968, 117.

Jensen, A.R. How much can we boost I.Q. and scholastic achievement? Harvard Educational Review, 1969, 39, 1-123.

Jensen, A.R. and Frederiksen, J. Social class differences in free recall of categorized and uncategorized lists. In A.R. Jensen and W.E. Rohwer, Jr., Experimental Analysis of learning abilities in culturally disadvantaged children. Final report on OLO project No. 2404, U.S. Office of Econimic Opportunity, 1970, 103-118.

Kobasigawa, A. and Middleton, D.B. Free recall of categorized items by children at three grade levels. Child Development, 1972, 43, 1067-1072.

Laurence, M.W. Age difference in performance and subjective organization in the free-recall learning of pictorial material. Canadian Journal of Psychology, 1966, 20, 388-399.

Labov, W. The logic of Nonstandard English. In F. Williams (Ed.), Language and poverty. Chicago: Markham Publishing Co., 1970.

Mandler, G. Organization and Memory. In K.W. Spence and J.T. Spence (Eds.), The psychology of learning and motivation, Vol. I. New York: Academic Press, 1967.

Mandler, G., Pearlstone, Z., and Koopmanis, H.S. Effects of organization and semantic similarity on recall and recognition. Journal of Verbal Learning and Verbal Behaviour, 1969, 8, 410-423.

Miller, G.A. The magical number seven, plus or minus two: Some limits to our capacity for processing information. Psychological Review, 1956, 63, 81-97.

Mitler, M.M. and Harris, L. Dimension preference and performance on a series of concept identification tasks in kindergarten, first-grade and third-grade children. Journal of Experimental Child Psychology, 1969, 7, 374-384.

Moely, B.E., Olson, F.A., Halwes, T.G. and Flavell, J.H. Production deficiency in young children's clustered recall. Developmental Psychology, 1969, 1, 26-34.

Neimark, E., Slotnick, N.S. and Ulrich, T. Development of memorization strategies. Developmental Psychology, 1971, 5, 427-432.

Odom, R.D. Effects of perceptual salience on the recall of relevant and incidental dimensional values: A developmental study. Journal of Experimental Psychology, 1972, 92, 285-291.

Rossi, E. Development of classificatory behaviour. Child Development, 1964, 35, 137-142.

Segal, E.M. Hierarchical structure in free recall. Journal of Experimental Psychology, 1969, 80, 59-63.

Searle, L.V. Cited in M.E. Hertzig et al, Class and ethnic differences in the responsiveness of preschool children to cognitive demands. Monographs of the Society for Research in Child Development, 1968, 117.

Shapiro, S.I. and Moely, B.E. Free recall, subjective organization, and learning to learn at three age levels. Psychonomic Science, 1971, 23, 189-191.

Schuell, T.J. Clustering and organization in free recall. Psychological Bulletin, 1969, 72, 353-374.

Siegel, S. Nonparametric statistics for the behavioural sciences. New York: McGraw-Hill Book Co., 1956.

Suchman, R.G. and Trabasso, T. Stimulus preference and cue function in young children's concept attainment. Journal of Experimental Child Psychology, 1966, 3, 188-198.

Thomson, D.M. and Tulving, E. Associative encoding and retrieval: Weak and strong cues. Journal of Experimental Psychology, 1970, 86, 255-262.

Tryon, R.C. Cited in M.E. Hertzig et al, Class and ethnic differences in the responsiveness of preschool children to cognitive demands. Monographs of the Society for Research in Child Development, 1968, 117.

Tulving, E. Subjective organization in free- recall of unrelated words. Psychological Review, 1962, 69, 344-354.

Tulving, E. and Pearlstone, Z. Availability versus accessibility of information in memory for words. Journal of Verbal Learning and Verbal Behaviour. 1966, 5, 381-391.

Tulving, E. and Osler, S. Effectiveness of retrieval cues in memory for words. Journal of Experimental Psychology, 1968, 77, 593-601.

Wechsler, D. Wechsler intelligence scale for children. Manual. New York: The Psychological Corporation, 1949.

Winer, B.J. Statistical principles in experimental design. New York: McGraw-Hill, 1962.

APPENDIX I

PICTURES USED FOR THE PREFERENCE TASK

1.	BLUE SLIDE	BLUE FLOWER	RED SWING
2.	SILVER BELL	BLACK HAMMER	SILVER SAW
3.	GREEN PANTS	RED DRESS	GREEN KITE
4.	RED BED	RED TRUCK	YELLOW BUS
5.	YELLOW SOCKS	RED HOUSE	RED SHOE
6.	YELLOW DUCK	RED APPLE	YELLOW BANANA
7.	ORANGE ORANGE	GREEN GRAPES	GREEN LEAF
8.	RED SPINNING TOP	BLUE TOY BEAR	BLUE SUITCASE
9.	BROWN GUITAR	BROWN BOOT	RED DRUM
10.	ORANGE HAT	ORANGE CARROT	BROWN MITTEN

Each line represents the placement of pictures on one page.

The four following orders of presentation were used:

a) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

b) 10, 9, 8, 7, 6, 5, 4, 3 ,2, 1.

c) 2, 4, 6, 8, 10, 1, 3, 5, 7, 9.

d) 9, 7, 5, 3, 1, 10, 8, 6, 4, 2.

APPENDIX II

EXPERIMENTAL PROCEDURE

(When S enters experimental room, E spends a couple of minutes getting acquainted, and setting S at ease. Then E fills out essentials on data sheet.)

Preference Test: All Groups

We are now going to look at some nice pictures in this book I have in front of me. (E turns to first page.) See, aren't these nice? Show me which two of these pictures go together. (S responds, and preference test continues in the same way for the 9 remaining trials. Ss with mixed preferences are eliminated from the study).

Digit Span Test: All Groups

(E follows instructions in manual. Ss failing digit span test are at this point eliminated from the study. All Ss are commended on performance.)

Familiarization: Control Group

(Pictures have been shuffled by E, laid out randomly in a 4X4 array, and covered with a cloth before Ss entry into the room).
Now I have some more really nice pictures to show you. They're right underneath this cloth, and I'll show them to you in a minute. First we're going to look at them, and talk about them a little bit. After

we've done that I'm going to give you a couple of minutes to look at them all by yourself, to look at them really hard. Because after that I'm going to collect the pictures, and you're going to tell me all the ones you can remember. After we look at the pictures and talk about them, it will be quite easy for you to remember them.

Familiarization: Colour and Function Instructions

(Pictures have been shuffled by E, laid out randomly in 4 X 4 array, and covered with a cloth before Ss entry into the room)
Now I have some more really nice pictures to show you. They're right underneath this cloth, and I'll show them to you in a minute. First we're going to look at them and talk about them a little bit. Then I'm going to show you a special way to put the pictures together to help you remember them later on. After that I'm going to give you a couple of minutes to look at them by yourself, to look at them really hard. Because after that I'm going to collect the pictures, and you're going to tell me all the ones you can remember.

Familiarization continued: All Groups.

O.K. Do you want to see the pictures? (E removes cloth) Now can you tell me the names of all these pictures, and what colour each of them is? (E indicates top left, then proceeds along the row. E then continues to second row, etc., as in normal reading fashion. The children will probably have to be prompted for the first few pictures.-e.g., E points to the first picture and says "What's this? What colour is it?" If children use an alternate label for a picture, e.g., "beans" for "peas", or cock-a-doodle-doo" for "rooster", and the label is reasonably appropriate, E accepts it both during this phase and in recall. If S cannot identify a picture or colour, E identifies it for him, and returns to it again to make sure he can recognize it before study period begins.)

Instructions: Control Group

(E collects cards and shuffles them, then lets them fall in a loose pile on the table.) Soon we're going to play a memory game. In a few minuted I'll give you a chance to look at these pictures and learn them. But first I'm going to let you lay the pictures out yourself. Laying the pictures out like this will help you remember them later on. Take any picture you like, and put it over here. (E points to the top left hand corner.) What is this picture of? (E continues by asking S to place the next three pictures of his choice, one at a time, in a column under the first one. As S places each picture, he is asked to label it. In a similar fashion, S lays out the remaining pictures proceeding in columns from left to right until all are entered into a 4 X 4 array.) Very good! You're terrific! You seem to know them all. Now can you tell me how many rows there are? (E indicates column) And how many pictures in each row? Good! (E collects the pictures and shuffles them.)

Instructions: Colour and Function

(E collects cards and shuffles them, then lets them fall in a loose pile on the table.) Soon we're going to play a memory game. In a few minutes I'll give you a chance to look at these pictures and learn them. But now I'm going to show you a special way of putting the pictures together which will help you remember them later on.

Function. First, can you find me a picture of an animal? Good! Now put it over here. (E points to the top left hand corner) What kind of animal is this? (E continues by asking S to find the three remaining animal pictures, one at a time, in any order, and to place each in a column under the first one. As S places each picture, he is asked to label it. The procedure is repeated for "vegetables we eat", "drinks", and "growing things" in that order from left to right. E has S place the columns far enough apart so that the categories are spatially distinct.)

Colour (Procedure is exactly as for function with the colour categories, brown, orange, white and green, replacing function categories, in the given order.)

Function Very good! You're terrific! You seem to know them all. Now can you tell me how many groups there are? And how many pictures in each group? Good! (E collects the pictures and shuffles them.)

Colour Very good! You're terrific! You seem to know them all. Now can you tell me how many colour groups there are? And how many pictures for each colour? Good! (E collects the pictures and shuffles them.)

Study Period I: Control Group

(E lays the pictures out again randomly in a 4 X 4 array.) O.K. Now I'm going to give you a chance to spend a few minutes looking at these pictures. Look at them really hard, and try to learn them, so that later when I take the pictures away, you'll be able to remember as many as possible. The harder you try to learn the pictures, the more you'll be able to remember. While you're trying to learn the pictures you can move them around any way you want to. I'll be with you again in a few minutes; I have some work to do now. (E moves chair a few feet from S and attends to paper work. If S does not attend to study, E does not prompt him. If S speaks to E, E reminds him she is busy and tells him she will be with him in a minute. The study period is 90 seconds.)

Study Period I: Colour and Function

(E lays the pictures out again randomly in a 4 X 4 array.) O.K. Now I'm going to give you a chance to spend a few minutes looking at these pictures. Look at them really hard, and try to learn them, so that later when I take the pictures away, you'll be able to remember as many as possible.

Function. When you're trying to learn the pictures, the best way to do it is to try to learn the animals together, the vegetables together, the drinks together, and the growing things together.

Colour. (As for function, except E substitutes brown, orange, white and green)

Function and Colour. You can move the pictures around any way you want to. I'll be with you again in a few minutes; I have some work to do. (E moves chair a few feet from S and attends to paper work. If S does not attend to study, E does not prompt him. If S speaks to E, E reminds him she is busy, and tells him she will be with him in a minute. The study period is 90 seconds.

Free Recall I: All Groups

(E collects the pictures and places them face down on the table in a pile.) Now, tell me the names of all the pictures you can remember. (Maximum Recall period is 2 minutes, but can stop any time after the end of the first minute if S can remember no more items. If S says he cannot remember any more before the end of the first minute, E encourages him by saying "I'll bet you can remember some more..you've done very well so far..think hard.. What other pictures did you see?" These are examples of possible prompts, and ought not to be used in a flowing pressured way.)

Study Period II: All Groups

(After end of first trial, E shuffles the pictures and lays them out as before.) You've done really well. You remembered a lot of pictures. Now I'm going to give you another chance to look at the pictures just as you did before. Try to learn them really well, and maybe next time you'll remember even more than you did this time. Remember, you can move the pictures around if you want to.

Free Recall II: All Groups

(As for Free Recall I)

Cued Recall: All Groups

(Immediately after the second free recall trial is over, E provides function cues as follows:) Now tell me what animal pictures you can remember? (The same question is asked for vegetables-we-eat, drinks, and growing things. Before the S returns to his classroom, E commends him, regardless of his performance.)

APPENDIX III

TABLES OF ANALYSES DESCRIBED IN THE RESULTS SECTION

TABLE A

ANALYSIS OF VARIANCE OF CORRECT RESPONSES AS A FUNCTION OF AGE, SES, INSTRUCTION CONDITION, AND TRIALS

Source	df	MS	F	p
Between	143	12.426		
Treatments				
Age	1	364.500	37.80	<.01
SES	1	13.347	1.38	n.s.
Instruction Condition(Instr)	2	2.542	.26	n.s.
Age X SES	1	2.000	.21	n.s.
Age X Instr.	2	28.625	2.97	n.s.(.10>p>.05)
SES X Instr.	2	.681	.07	n.s.
Age X SES X Instr.	2	30.167	3.13	<.05
Error	132	9.644		
Within	144	2.222		
Treatments				
Trials	1	34.722	18.68	<.01
Trials X Age	1	11.681	6.28	<.05
Trials X SES	1	18.000	9.68	<.01
Trials X Instr.	2	.389	.21	n.s.
Trials X Age X SES	1	.681	.37	n.s.
Trials X Age X Instr.	2	1.264	.68	n.s.
Trials X SES X Instr.	2	2.042	1.10	n.s.
Trials X Age X SES X Instr.	2	1.097	.59	n.s.
Error	132	1.859		

TABLE B

MEDIAN CORRECT RESPONSES OF FIVE-YEAR OLDS ON FREE RECALL IN RELATION TO PREFERENCES, ACTUAL INSTRUCTIONS, SES, AND TRIALS

1. Function Preferrers (n = 46) versus Colour Preferrers (n = 26)

Trial 1:	Function Preferrers	9.00	Colour Preferrers	8.00	N.S.
Trial 2:	Function Preferrers	10.00	Colour Preferrers	8.00	$p<.05$

2. Function Preferrers: Low SES (n=20) versus Middle SES (n=26)

Trial 1:	Low SES	9.00	Middle SES	8.50	N.S.
Trial 2:	Low SES	9.00	Middle SES	10.00	N.S.

3. Colour Preferrers: Low SES (n=16 versus Middle SES (n=10)

Trial 1:	Low SES	8.00	Middle SES	7.00	N.S.
Trial 2:	Low SES	7.50	Middle SES	8.50	N.S.

4. Function Instructions (n=25) versus Colour Instructions (n=23)

Trial 1:	Function Instructions	8.00	Colour Instructions	8.00	N.S.
Trial 2:	Function Instructions	9.00	Colour Instructions	8.00	N.S.

5. Function Preferrers: Function Instructions (n=16) versus Colour Instructions (n=15)

Trial 1:	Function Instructions	8.00	Colour Instructions	9.00	N.S.
Trial 2:	Function Instructions	9.50	Colour Instructions	10.00	N.S.

6. Colour Preferrers: Function Instructions (n=9) versus Colour Instructions (n=8)

Trial 1:	Function Instructions	8.00	Colour Instructions	7.00	N.S.
Trial 2:	Function Instructions	9.00	Colour Instructions	7.00	N.S.

TABLE C

ANALYSES OF VARIANCE OF CORRECT RESPONSES
FOR SEVEN-YEAR OLD FUNCTION PREFERRERS
ON TRIALS 1 AND 2, AS A FUNCTION OF
SES AND ACTUAL INSTRUCTIONS

TRIAL 1

Source	df	MS	F	p
SES	1	.021	.004	N.S.
Actual Instructions (Act. Instr)	2	12.310	2.33	N.S.
SES X Act Instr.	2	7.578	1.44	N.S.
Error	59	5.279		
Total	64	5.488		

TRIAL 2

Source	df	MS	F	p
SES	1	40.472	5.82	$< .05$
Act. Instr.	2	30.496	4.39	$< .05$
SES X Act. Instr.	2	1.364	.20	N.S.
Error	59	6.949		
Total	64	8.034		

TABLE D

ANALYSIS OF VARIANCE OF PRIMARY CLUSTERING
AS A FUNCTION OF AGE, SES, INSTRUCTION
CONDITION AND TRIALS

Source	df	MS	F	p
Between	143	.0839		
Age	1	.0091	.12	N.S.
SES	1	.6466	8.43	<.01
Instruction Condition (Instr)	2	.3941	5.14	<.01
Age X SES	1	.0033	.04	N.S.
Age X Instr	2	.0283	.37	N.S.
SES X Instr	2	.1641	2.14	N.S.
Age X SES X Instr	2	.0172	.22	N.S.
Error	132	.0767		
Within	144	.0390		
Trials (T)	1	.0284	.71	N.S.
T X Age	1	.0136	.34	N.S.
T X SES	1	.0420	1.05	N.S.
T X Instr	2	.0841	2.11	N.S.
T X Age X SES	1	.0034	.09	N.S.
T X Age X Instr	2	.0210	.52	N.S.
T X SES X Instr	2	.0143	.36	N.S.
T X Age X SES X Instr	2	.0057	.14	N.S.
Error	132	.0399		N.S.

TABLE E

ANALYSIS OF VARIANCE OF INSTRUCTED MINUS UNINSTRUCTED CLUSTER SCORE[a] AS A FUNCTION OF AGE, SES, INSTRUCTION CONDITION AND TRIALS

Source	df	MS	F	p
Between	95	.4848		
Age	1	.1430	.34	N.S.
SES	1	1.5441	3.70	N.S. (.10 > p > .05)
Instruction Condition (Instr)	1	3.3138	7.94	< .01
Age X SES	1	1.4791	3.54	N.S. (.10 > p > .05)
Age X Instr	1	1.3363	3.20	N.S. (.10 > p > .05)
SES X Instr	1	1.0455	2.50	N.S.
Age X SES X Instr	1	.4549	1.09	N.S.
Error	88	.4175		
Within	96	.1401		
Trials (T)	1	.0188	.14	N.S.
T X Age	1	.1077	.79	N.S.
T X SES	1	.0808	.59	N.S.
T X Instr	1	.0077	.06	N.S.
T X Age X SES	1	.3913	2.86	N.S. (.10 > p > .05)
T X Age X Instr	1	.7573	5.53	< .05
T X SES X Instr	1	.0297	.22	N.S.
T X Age X SES X Instr	1	.0130	.10	N.S.
Error	88	.1369		

[a] + 1 was added to all values to eliminate any minus signs.

Table F

MEDIAN PRIMARY CLUSTERING OF FIVE-YEAR OLDS IN RELATION TO PREFERENCES, ACTUAL INSTRUCTIONS, SES, AND TRIALS

1. Function Preferrers (n=46) versus Colour Preferrers (n=26)

Trial 1: Function Preferrers .667 Colour Preferrers .634 N.S.
Trial 2: Function Preferrers .600 Colour Preferrers .667 N.S.

2. Function Preferrers: Low SES (n=20) versus Middle SES (n=26)

Trial 1: Low SES .667 Middle SES .634 N.S.
Trial 2: Low SES .600 Middle SES .598 N.S.

3. Colour Preferrers: Low SES (n=16) versus Middle SES (n=10)

Trial 1: Low SES .571 Middle SES .834 N.S.
Trial 2: Low SES .465 Middle SES .922 $p < .05$

4. Function Instructions (n=25) versus Colour Instructions (n=23)

Trial 1: Function Instructions .667 Colour Instructions .600 N.S.
Trial 2: Function Instructions .600 Colour Instructions .600 N.S.

5. Function Preferrers: Function Instructions (n=16) versus Colour Instructions (n=15)

Trial 1: Function Instructions .744 Colour Instructions .500 $p < .05$
Trial 2: Function Instructions .613 Colour Instructions .500 N.S.

6. Colour Preferrers: Function Instructions (n=9) versus Colour Instructions (n=8)

Trial 1: Function Instructions .571 Colour Instructions .675 N.S.
Trial 2: Function Instructions .600 Colour Instructions .834 N.S.

TABLE G

ANALYSIS OF VARIANCE OF COLOUR CLUSTERING FOR 7-YEAR OLD FUNCTION PREFERRERS AS A FUNCTION OF SES AND ACTUAL INSTRUCTIONS ON TRIALS 1 AND 2

Trial 1

Source	df	MS	F	p
SES	1	.2247	5.21	$< .05$
Actual Instructions	2	.5223	12.12	$< .01$
SES X Actual Instructions	2	.1242	2.88	$.10 > p > .05$
Error	59	.0431		
Total	64	.0634		

Trial 2

Source	df	MS	F	p
SES	1	.1020	1.64	N.S.
Actual Instructions	2	.4563	7.31	$< .01$
SES X Actual Instructions	2	.2502	4.01	$< .05$
Error	59	.0624		
Total	64	.0812		

TABLE H

ANALYSIS OF VARIANCE OF FUNCTION CLUSTERING FOR 7-YEAR OLD FUNCTION PREFERRERS AS A FUNCTION OF SES AND ACTUAL INSTRUCTIONS ON TRIALS 1 AND 2

Trial 1

Source	df	MS	F	p
SES	1	.1944	3.02	.10 > p > .05
Actual Instructions	2	.7790	12.10	< .01
SES X Actual Instructions	2	.3177	4.94	< .05
Error	59	.0644		
Total	64	.0966		

Trial 2

Source	df	MS	F	p
SES	1	.0028	.04	N.S.
Actual Instructions	2	.4681	7.10	< .01
SES X Actual Instructions	2	.4590	6.96	< .01
Error	59	.0660		
Total	64	.0898		

TABLE I

ANALYSIS OF VARIANCE OF CUED RECALL SCORES AS A FUNCTION OF AGE, SES, AND INSTRUCTION CONDITION

Source	df	MS	F	p
Age	1	121.000	24.86	<.01
SES	1	1.361	.28	N.S.
Instruction Condition(Instr)	2	7.563	1.55	N.S.
Age X SES	1	2.778	.57	N.S.
Age X Instr	2	7.271	1.49	N.S.
SES X Instr	2	.632	.13	N.S.
Age X SES X Instr	2	6.590	1.35	N.S.
Error	132	4.867		
Total	143	5.677		

TABLE J

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN MEAN FREE RECALL SCORES AND CUED RECALL SCORES AS A FUNCTION OF AGE, SES, AND INSTRUCTION CONDITION

Source	df	MS	F	p
Age	1	4.877	1.18	N.S.
SES	1	3.516	.85	N.S.
Instruction Condition(Instr)	2	5.734	1.39	N.S.
Age X SES	1	.293	.07	N.S.
Age X Instr	2	6.460	1.56	N.S.
SES X Instr	2	2.380	.58	N.S.
Age X SES X Instr	2	1.627	.39	N.S.
Error	132	4.135		
Total	143	4.104		

TABLE K

MEDIAN CUED RECALL SCORES OF FIVE-YEAR OLDS IN RELATION TO PREFERENCES, ACTUAL INSTRUCTIONS, AND SES

1. Function Preferrers (n=46) versus Colour Preferrers (n=26)

   Function Preferrers 11.00 Colour Preferrers 9.50 $p < .05$

2. Function Preferrers: Low SES(n=20) versus Middle SES(n=26)

   Low SES 11.00 Middle SES 11.00 N.S.

3. Colour Preferrers: Low SES(n=16) versus Middle SES(n=10)

   Low SES 10.00 Middle SES 8.50 N.S.

4. Function Instructions(n=25) versus Colour Instructions(n=23)

   Function Instructions 12.00 Colour Instructions 9.00 $p < .05$

5. Function Preferrers: Function Instructions(n=16) versus Colour Instructions(n=15)

   Function Instructions 12.00 Colour Instructions 10.00 $p < .05$

6. Colour Preferrers: Function Instructions(n=9) versus Colour Instructions(n=8)

   Function Instructions 12.00 Colour Instructions 7.50 $p < .05$

TABLE L

ANALYSIS OF VARIANCE OF CUED RECALL SCORES
FOR SEVEN-YEAR OLD FUNCTION PREFERRERS
IN RELATION TO ACTUAL INSTRUCTIONS
AND SES

Source	df	MS	F	p
SES	1	4.21	1.05	N.S.
ACTUAL INSTRUCTIONS	2	18.66	4.65	<.05
SES X ACTUAL INSTRUCTIONS	2	2.07	.515	N.S.
ERROR	59	4.01		
TOTAL	64	4.41		