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# The effect of stimulus materials and pretraining on children's performance and error choice behavior in a two-trial inference task.

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peace

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## Introduction

The two-trial concept identification task is particularly appropriate for studying inferential capabilities of young children. When instances are presented in specified ways, the correct concept may be determined regardless of whether it occurs on both, only one, or on neither of the two trials. In addition, when attributes are dimensional in nature and limited to two values per dimension, information about one value is information about the other value. Previous experimenters have used the two-trial inference problem to study the child's ability to infer a conjunctive concept (Huttenlocher, 1964, 1967), to infer a single value from two dimensions (Scholnick, 1970, 1971a, b, c; Daehler, 1972), and to infer a single attribute from one dimension (Daehler, 1972). Training and stimulus materials were varied in the present experiment to study their influence on the child's processing of dimensionalized values in an inference task.

### The two-trial inference task.

The two-trial concept identification problem requires subjects to use information presented on two trials in selecting the "correct" answer from among four possible members of the inference set. In each problem, two stimulus instances are presented on each trial along with information indicating whether the correct answer is present (+) in, or absent (-) from the pair displayed. The pair

of stimulus instances displayed on the second trial includes one of those occurring on Trial One and a new instance from the inference set. Therefore, three of the four members of the inference set are shown on the two trials. Given these constraints, four different types of problems are defined by the presence or absence of the correct attribute on the two trials. For example, in the concept identification task, assume red, blue, star and circle are the inference set and a patch of blue is paired with an outline circle on Trial One and a patch of red with an outline circle on Trial Two. If the correct attribute occurs on both trials (++) the answer must be circle; if only on the first trial (+-) the answer must be blue; if only on the second trial (-+) the answer must be red; and finally if the correct attribute is not shown on either trial (--) the answer must be star, the fourth and absent attribute in that problem. In a similar manner, a conjunctive concept may be specified with an inference set such as red circle, red star, green circle and green star. Assume that a red circle and a red star are presented on Trial One, and a red circle and a green star are presented on Trial Two. If the concept is present on both trials (++) the answer must be red circle; if the concept is present only on the first trial (+-) the answer must be red star; if it is present only on the second trial (-+) the answer must be green star; and finally if the correct concept is not

shown on either trial (--) the answer must be green circle for that problem.

The solution process; theory and data.

Logically all four types of problems (++, +-, -+, & --) should be of equal difficulty (Hovland & Weiss, 1953), that is, each can be solved given the information presented on the two trials. However, when the correct instance is on neither of the two trials and when the cues are attributes of two dimensions, it has been found that children consistently have greater difficulty inferring the positive instance (Daehler, 1970; Scholnick, 1970, 1971 a, 1971 c; Huttenlocher, 1964, 1967). In addition, the (-+) problem frequently has been found to be the easiest (Huttenlocher, 1964; Daehler, 1972). Huttenlocher using a conjunctive concept task, predicted both the ease of the (-+) problem and the difficulty of the (--) problem on the basis of two information processing biases of the subjects; subjects attend to cue change and subjects make greater use of those cues most recently available. Both stimulus change and availability are helpful to performance on (-+) problems but neither are helpful on (--) problems. The (+-) problem has stimulus change but not availability and the (++) problem has availability but not stimulus change and so these problems fall in between (--) and (-+) problems in difficulty.

Scholnick (1970) required identification of a single

attribute and found a developmental shift in the relative case of (++) and mixed (+-and-+) problems. The youngest children she tested (5 year-olds) found the (-+) and the (+-) problems to be the easiest to solve. Scholnick concluded that for these subjects stimulus change was important. However, the older groups of subjects (7 and 9 year-olds) found the (++) problems to be easiest and Scholnick suggested that older subjects were more attentive to cue repetition rather than to cue change. However, (--) problems were most difficult for subjects at all ages in an attempt to coordinate her findings with those of Huttenlocher. It was noted that in the conjunctive concept task utilized Huttenlocher more cues remain constant than change whereas in the concept identification task constant than change whereas in the concept identification task one dimension changes and one dimension stays co stant. Thus older subjects may shift attention to the constant cue when the changing and constant cues are e ual in number.

The problem of using information available in th stimuli.

Since failures to make use of all the information available in the stimuli are often cited as a sorce of errors for young children on a variety of conceptual tasks (e.g. Bruner, Olver, & Greenfield, 1966; Gelman, 1969) they shall be considered first in an attempt to explain the findings for two-trial inference problems.

Several interpretations alluding to biases have been offered by Scholnick (1970, 1971a, & 1971c) to account for

non-logical performance. The four problems are not solved with equal case because 1) as described in the preceding section, young children prefer the changing dimension and older children prefer the constant dimensions and both preferences lead to differing difficulties among problems, 2) the method of presentation may affect the availability of some cues and therefore affect difficulty of the problems dependent on that availability, and 3) direct information on stimuli is not offered in one type of problem and this may differentially affect the ease of that problem.

The concept identification task, as described earlier, requires one dimension to show one value on Trials One and Two (i.e. the value shown is "common" to Trial One and to Trial Two) and therefore, this dimension will be called the "constant dimension." Also, the inference task requires the other dimension to have a changing value from Trial One to Trial Two, and that dimension will be called the"changing dimension." A bias for the changing dimension or for the constant dimension can be revealed in the responses made by the subjects. Each cue has a location in the stimulus array. That is, the cue chosen on a particular problem ( whether correct or incorrect) must be located on both trials (i.e. the common cue), or on just the first trial, or on just the second trial, or on neither trial (i.e. the absent cue). It should be pointed out that for each type of problem (++, +-, -+, & --) there is one correct location cue and

three incorrect location cues. For example, for all (+-) problems the cue located only on the first trial is correct. All other cue locations are incorrect.

If certain locations are preferred or ignored the performance on the four types of problems would be differentially affected. The preference for a certain location may be revealed not only through order of problem difficulty but also through analysis of the location of the cues offered incorrectly as hypotheses. An examination of the responses made by subjects in Scholnick's 1970 and 1971a studies revealed that the percentage of errors citing the cue on the constant dimension increased with age whereas the percentage of errors which cited either cue on the changing dimension decreased with age (Scholnick, 1970, 1971a). In addition, the absent cue was cited least often by all ages. In these studies, the performance on each type of problem followed the preferences indicated in the error location analysis. That is, the youngest subjects performed relatively better on the (-+) and the (+-) problems whereas the oldest subjects did relatively better on the (++) problem.[1] More importantly, the low frequency of citation of the cue occurring on neither of the two trials correlates with the poorest performance on that problem for all ages.

Just as attention can limit the available cues during an inference task and differentially affect the difficulty

of different types of problems, so to can memory factors influence the availability of cues for solution of the inference task (Scholnick, 1971a). There are two methods for presenting materials which may affect availability; either Trial One is put down and removed prior to Trial Two (successive presentation) or Trial One and Trial Two are available at the time of the response (simultaneous presentation). The former presumably puts more of a strain upon memory than the latter since with the first method the Trial One stimuli are removed with the onset of Trial Two. Therefore, the first value of the changing dimension, and, in addition, the absent cue, are not in recent memory or perceptually available at the time of the subject's response. Presentation of the two trials simultaneously should aid availability of the cues from the first trial, but not the absent cue. On the other hand, the availability of the absent cue, Scholnick reasoned, may be enhanced by providing a list of the four stimuli in the inference set. The provision of such a list should increase the likelihood that the alternative to the negative instances would be in memory just as those cues presented during the course of the problem.

In general, she found that performance on any of the four types of problems was not enhanced by simultaneous presentation of the trials or by memory aids. However, successive presentation may have affected the

problems differentially. For example, the (-+) problem had a lower overall error rate (although non-significant) and a lower number of citations of the incorrect value on the correct dimension (significant) when the trials were presented successively. For the (-+) problem the incorrect value on the correct dimension (significant) when the trials were presented successively. For the (-+) problem the incorrect value on the correct dimension is the cue occurring on only the first trial and that cue is on longer present at the time of responding when trials are presented successively. Errors citing the cue which occurred on neither trial were infrequent and the (--) problem remained more difficult than other types of problems.

In Scholnick's most recent published study (1971c) a new approach to the difficulty of the -- problem was offered. She suggested that the subject was reluctant to choose, for his answer, a feature upon which he had no direct information. In other words, the presence of the cue upon which to apply information is more important than the information to be applied.

This study used an inference task with a usage task inserted after each problem. After the subject gave his verbal guess of the relevant cue on the inference problem he was shown eight stimulus pictures; two he had " just seen," two others from the inference set and four figures generalizable from the inference set. The usage set consisted of

the four inference set members (i.e. red circle, red square, blue circle and blue square) and four generalization members (i.e. green circle, green square, red and blue triangles). All eight were mounted on a board and shown to all the subjects. Each subjects indicated after each problem which ones of the usage set were the same name as the one he gave as his guess. For example, if the subject was shown a red and a blue circle and guessed red then he was to find the red stimuli on the usage board, i.e. red circle (just seen), red square ( inference set) and red triangle ( generalization stimuli).

On the inference task the (--) problem again proved to be the most difficult. The easiest problems were the (-+) and the (+-) problems. She applied a direct information hypothesis to interpret the results for the inference task. She explained the solvability of the (+-) problems by saying their relative ease resulted from direct information about both positive and negative instances on one dimension. The (--) problem remained most difficult because it did not include direct information on a postive instance. Presumably the intermediate difficulty of the (++) problem is due to direct information available only for the postive instances on the relevant dimension.

Support for the direct information hypothesis was offered through analysis of the usage task. Of the omissions which occurred in the usage task responses, the fewest

occured in the "just seen" category. For Scholnick, this result indicated a reluctance on the part of the subjects to extend hypotheses beyond their personal information domain. One reason that the child may have great difficulty on the (--) problem may be because the child fails to convert the information about one attribute of a dimension presented in the array into information about the alternative which is not presented in the array.

The problem of transformation of information about stimuli: the present interest.

Scholnick's discussion of direct information has emphasized the importance of the instances presented in the stimulus array. This section will emphasize the steps required for transformation of presented information into usable information about that alternative not presented in the stimulus array. In addition, the dimensional structure of the inference set and its possible influence on the solvability of the inference problems will be considered.

In an early study, Scholnick (1971a) suggested that difficulty in transforming information from negative instances, may be the basis for the difficulty of the (--) problem. A similar notion concerning the transformation of negative information to positive has been described by Eimas (1970) who has used a hypothesis testing procedure. He called this type of transformation "recording". In the two-trial inference task the positive cue in the (--)

problem may be arrived at through conversion of negative information to positive information about the alternative value, but this recoding involves several steps. First, the negative information must indicate to the subject that the correct cue has not occurred in the stimulus array. Second, in the (--) problem the attribute presented twice is on the correct dimension but the value shown is incorrect. So, prior to solution, the other value on that dimension must become available despite the perceptual recurrence of the negative cue on the relevant dimension. Finally, the subject must realize that the alternative, not presented (in the stimulus array) value is correct.

There is some suggestion that the dimensional structure of the stimulus materials may affect the ease of recoding. Scholnick and Huttenlocher, using binary dimension, consistently reported the greater difficulty of the (--) problem. However, Daehler (1972) using unidimensional cues (four attributes which could be assigned to one dimension) found that the (--) problem was equal in difficulty to the other types of problems for third graders. It is important to test the influence of stimulus structure before the source of the difficulty in transformation of the presented information can be offered.

It is proposed here that two aspects of dimensionalized cues will influence processing in inference problems; the exclusive nature of values that represent the stimulus

dimension and the association between the values. Previous studies using two values on a dimension made use of values on both dimensions arbitrarily chosen from the set of all possible values. It is maintained that if two values are to be the only two representatives for a dimension, they should be exclusive and to as great a degree as conceptually possible, exhaustive of the dimension. That is, the subject should perceive that values A and B exhaust the set of values possible for the dimension. It is hypothesized that the awareness of the limited set may facilitate recoding by providing the subject with the knowledge that there is only one alternative to the value on which information has been given. It may be easier for subjects to use negative information pertinent to one member of a pair of attributes and apply it to the other member if it is readily apparent that the other member of the pair is the only other alternative on that dimension.

The other aspect of interest is how immediately available the exclusive alternative is prior to recoding, i.e. the ease of getting from one value to the other value on a dimension. By having values which are opposites or high associates, one could expect availability of the alternative to be influenced. If two values are opposites they are likely to be a more highly associated pair, a pair the child has been exposed to as being related, than any two arbitrarily chosen values and therefore could facilitate recoding. A

major requirement of the (--) problem, using dimensional stimuli, is the production of the alternative value on the relevant dimension prior to the recoding of the given information. Earlier it was suggested that awareness of the limited set will reduce the field of alternatives, thus, a factor which facilitates the availability of the alternative should also help the performance of the subject on the (--) problem.

Antonyms are the extremes of a continuum and their opposite status should exemplify a limited set of alternatives and high associativity. The values "up" and "down" are exclusive and nearly exhaustive values and given one value, the other value is readily available. Therefore, antonyms have inherent descriptive and operational characteristics that the set red and blue might not have for the child. That is, there is no natural limitation of red and blue as the only two colors and there is no natural conceptual relationship between them. With children, the use of materials or training emphasizing these two characteristics could give a more accurate picture of inferential abilities as well as factors influencing the child's performance on the inference task.

Two factors were varied for study in the present experiment. Pretraining was given to half of the subjects. It emphasized the limited set of values to be used and presumably established a high association between the two values

on the dimensions used. In addition, two sets of stimulus materials, assumed to vary in terms of the assumptions of a limited set of values and high association between the two values were used. One set of materials consisted of the usual arbitrarily chosen materials on standard dimensions and the second consisted of natural opposites.

The hypotheses are simple: there are two characteristics which are part of the logical assumptions of concept identification tasks with binary dimensions and that these influence performance in two-trial concept identification tasks. It is proposed that inferential limitations in the use of dimensional materials should not be ascribed to young children without further investigation of the influential aspects of the dimensional organization. In addition, upon discovery of a failure of inference, alternative strategies used in solution of these problems should be considered.

## Method

<u>Subjects</u>. Nine males and nine females from Grade two, were randomly assigned to each of four experimental conditions. The mean age in years and months for the 72 subjects was 8-0 and the range was 7-5 to 8-11.[3].

<u>Design</u>. A 2(Training) x 2(Stimulus Material) x 2(Sex) x 4(Type of Problem) design was used. Type of Problem was a within subject variable.

Stimulus materials. The Opposites groups were tested using pictures of natural opposites. These task materials should emphasize, with or without pretraining, the the values exhaust the set and solely represent the dimension and in addition, should assure high associativity of one value to the other. The set consisted of pictures of two values on two dimensions; Direction ( a bottle standing up and lying down on a table) and Location ( a ball in a glass and outside of a glass on a table). Examples of these stimulus cards can be seen in Figure 1 of Appendix A. The stimuli were drawn on a white background in black ink and reproduced.

The Arbitrary groups were shown a set of stimuli similar to those used by Scholnick (1971a) and Daehler(1972). These consisted of pictures of two values on two dimensions; Color (red and blue) and Form (circle and star). Examples of these stimuli may be seen in Figure 2 of Appendix A. Color was crayoned and form drawn in black outline on a white background and reproduced.

Pretraining. Prior to the actual inference task all groups were familiarized with the task and materials but the Trained groups were pretrained with specific emphasis on the limited nature of the set of alternative values and on the relationship between the two values on each dimension.

The Non-trained groups received the following instructions, while the experimenter showed each member of the inference set to the subject.

"Here are what we will play with. I call this red (for example), this is blue, this is circle, and this is star. Now (pointing to a stack of facedown cards on the experimenter's desk) these are my secret cards. My cards are just like the ones here and here (pointing to the stimulus card piles and to the response array of the four members of the inference set in front of the subject). I want you to figure out what my secret card is. I am going to give you two clues. I'll show you what I mean.

The experimenter placed two cards in the Trial One stimulus area and identified the attributes displayed. The experimenter then continued.

"Let me see what my secret card is ... (looking at the top facedown card on the experimenter's desk) I can (or can't) see my secret card here (pointing to the two cards in the stimulus area).

The experimenter then placed an information card showing a "Yes" or a "No" between the two cards in the stimulus area. The experimenter carried out the same sequence of activities for the second trial. After the second information trial was placed, the subject was asked, "Can you point, on your desk (response array) to what you guess my secret card to be?"

The Pretrained groups first received the following instructions:

"Here are the only two colors (for example) we will be playing with.

The experimenter takes one dimension at a time. The experimenter turns over both values for that dimension and asks the subject, "Can you tell me the two colors (for example) we are going to play with?" This is repeated until the subject is correct on each dimension twice. The experimenter then continued.

"If I say, 'left' you would say ... 'right'. If I say 'boy' you say ... 'girl', so if I say 'red' (for example) [The two values of one of the dimensions are held up] you would say ... (point to blue) 'blue', red and blue are opposites."

This is repeated until the subject provided rapid and correct responses twice for each value on each dimension. The game was then explained as described for the non trained group.

Procedure. All subjects were given twenty-four, two-trial concept identification problems block randomized so each of the types of problems (++, -+, +-, & --) appeared equally

often. Each of the four attributes were correct at least once per type of problem and correct equally often over the experiment.

The subjects were volunteers taken from their classroom to a small room. The subject was seated at a desk with the four attributes laid out in front of him. The experimenter's desk contained four stacks of stimulus cards (A in Figure 3, Appendix A), a stack of target cards in prearranged order face down (B), a piece of tape on the desk to demarcate between trials (C) and two cards with "Yes" on one side and "No" on the other (D). The information cards told the subject either that "Yes" the correct cue was present or "No" it was not present, on each trial.

The pairings of stimulus cards were determined randomly after the constraints of the occurrence of the type of problem and the randonly chosen relevant attribute were considered. Care was taken to avoid repetition of stimulus configurations on successive problems.

The stimuli for Trial One were taken, one from each dimension, and then placed side by side above the tape mark with a 3-inch space between them. The experimenter then picked the top card of the stack of target cards and looked at it to know which cue was positive for that problem. She then took one information card and set it appropriately between the two stimuli to indicate whether or not the correct cue was shown on Trial One. Two more

stimulus cards were then set out below the tape mark for the second trial. The second information card was then set on the basis of the target card and the stimuli presented. The configuration thus appeared by a tape strip with one value on one dimension repeated. On the basis of this information the subject was asked to point to one of the four attributes shown on his desk which he believed was the same as the target card the experimenter had the subject's response was recorded and he was shown the experimenter's target card., The table was then cleared and the next trial begun. Figure 3 in Appendix A shows a typical setup for the (+-) problem.

## Results

The mean number of correct and incorrect responses for each type of problem as a function of sex, and block of problems and location of response may be seen in Tables 1-4 in Appendix B. The twenty-four trials given each subject were divided into two blocks of twelve trials thus each type of problem occurred three times per block of trials.

Errors. The mean number of errors in each group for each type of problem appears in table 5 of Appendix B.

There are three comparisons of major interest. First, the mean number of errors for the Opposites Materials was 7.50 to 5.72 per subject for the Arbitrary Materials over all types of problems; the opposites materials obviously

did not facilitate performance on the inference problems. Second, the mean number of errors for the Trained group was 5.64 compared to 7.58 for the Non-Trained groups; training had an effect on the performance in the predicted direction over all types of problems. Third, the mean number of errors for the ++, -+, +-, and the -- problems was 1.40, 1.90, 1.80, and 1.48 errors respectively. The four types of problems differed in difficulty, as expected however, mixed instances were somewhat more difficult than (++) and (--) problems. In order to test the reliability of these findings a 2(Materials)x2(Sex)x2(Block)x4 (Type of problem) analysis of variance was performed. The results of this analysis are shown in Table 1.

The main effects of Training and Materials failed to materialize as a reliable influence on performance in the task. The main effects of Sex, Block and Type of Problem reached statistical significance, while no interactions were significant. Female subjects made fewer errors than males over all types of problems, 5.42 to 7.80, respectively ($F(1,64)=4.99$, $p= <.05$). In addition, performance improved, from the first twelve trials to the last twelve trials, 4.08 errors to 2.52 respectively ($F(1,64)=22.5, p= <.001$).

The most interesting significant main effect was the relative difficulty of the four types of problems ($F(3,192) =2.89$, $p<.01$). A Scheffe' multi-comparison test was done to compare the difficulty of the (++) and (--) problems to the (-+) and the (+-) problems. These two sets of means

Table 1

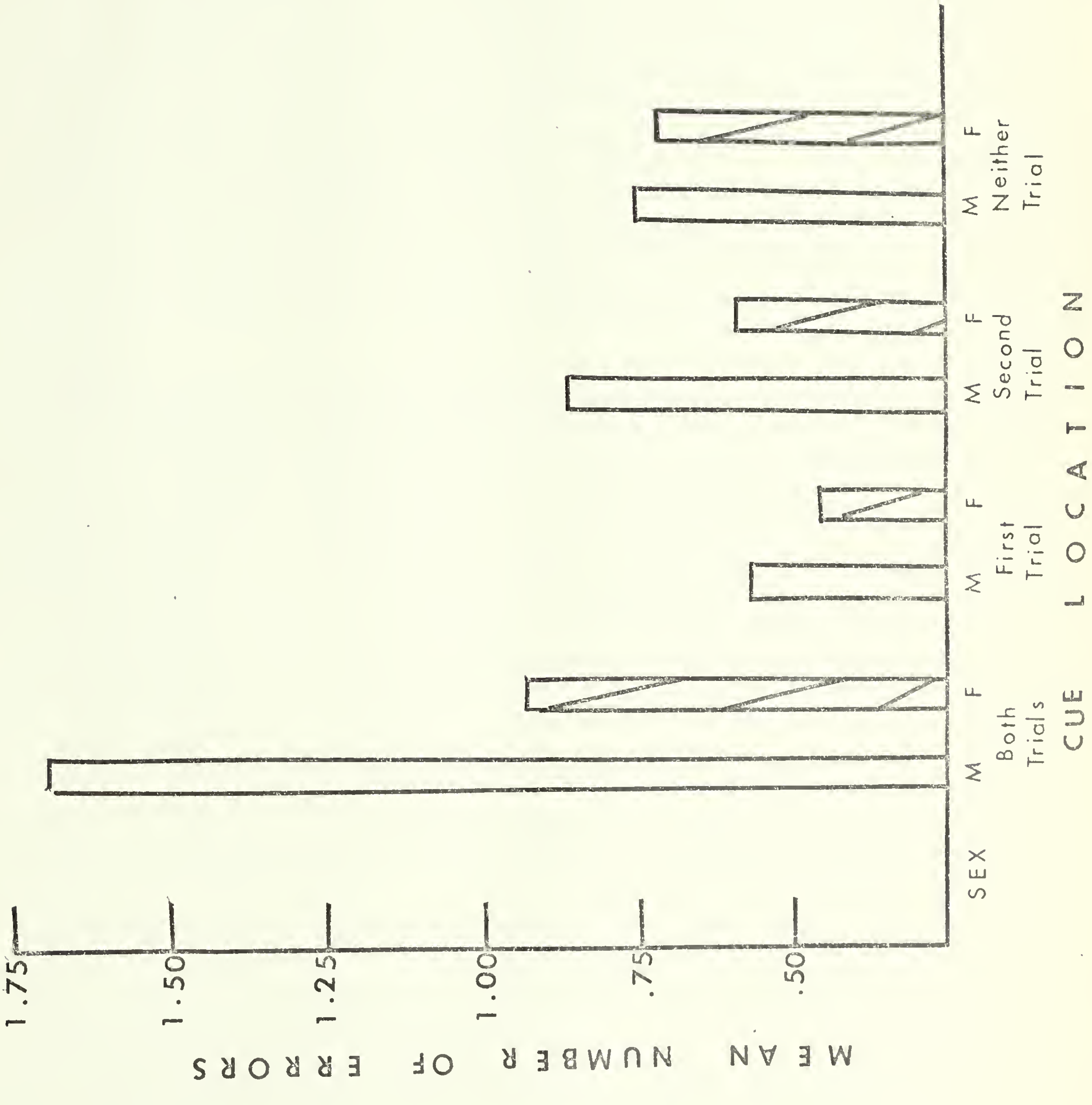
| Source | Sum of Squares | df | Mean Squares | F | p |
|---|---|---|---|---|---|
| Training | 8.5069 | 1 | 8.5069 | 3.31 | |
| Materials | 7.1111 | 1 | 7.1111 | 2.77 | |
| Sex(X) | 12.8403 | 1 | 12.8403 | 4.99 | .05 |
| Problem | 6.5000 | 3 | 2.1667 | 2.89 | .01 |
| Block | 21.7778 | 1 | 21.7778 | 2.29 | .001 |
| TM | 0.0625 | 1 | 0.0625 | | |
| TX | 1.3611 | 1 | 1.3611 | | |
| MX | 4.3404 | 1 | 4.3403 | 1.69 | |
| TP | 0.1875 | 3 | 0.0625 | | |
| MP | 2.1389 | 3 | 0.7130 | | |
| XP | 3.4097 | 3 | 1.1366 | 1.51 | |
| TB | 0.0069 | 1 | 0.0069 | | |
| MB | 0.2500 | 1 | 0.2500 | | |
| XB | 0.8403 | 1 | 0.8403 | | |
| PB | 0.8056 | 3 | 0.2685 | | |
| TMX | -0.0000 | 1 | -0.0000 | (rounding error) | |
| TMP | 1.1875 | 3 | 0.3958 | | |
| TXP | 2.5000 | 3 | 0.8333 | 1.11 | |
| MXP | 0.9097 | 3 | 0.3032 | | |
| TMB | 0.0069 | 1 | 0.0069 | | |
| TXB | 0.4444 | 1 | 0.4444 | | |
| MXB | 1.5625 | 1 | 1.5625 | 1.64 | |
| TPB | 2.5764 | 3 | 0.8588 | | |
| MPB | 1.7222 | 3 | 0.5741 | 1.21 | |
| XPB | 2.1875 | 3 | 0.7292 | 1.54 | |
| S(TMX) | 164.4167 | 64 | 2.5690 | | |
| TMXP | 1.2500 | 3 | 0.4167 | | |
| TMXB | 1.3611 | 1 | 1.3611 | | |
| TMPB | 0.4653 | 3 | 0.1551 | | |
| TXPB | 0.5833 | 3 | 0.1944 | | |
| MXPB | 2.6875 | 3 | 0.8958 | 1.90 | |
| SP(TMX) | 143.9167 | 192 | 0.7496 | | |
| SB(TMX) | 60.7500 | 64 | 0.9492 | | |
| TMXPB | 1.2778 | 3 | 0.4259 | | |
| SPB(TMX) | 90.6944 | 192 | 0.4724 | | |

were found to differ reliably at the $p = < .05$ level. Thus, the problems where the constant dimension was relevant were significantly easier than the problems in which the changing dimension was relevant. This result differs from previous studies in that the performance on the (--) problem was better than performance on the (-+) and (+-) problems and as good as performance on (++) problems.

Error location. Since each member of the inference set occupies a unique location in the stimulus array a measure of location bias may be obtained by examining the errors given by the subjects. Since one of the four locations is correct for each type of problem, location biases may also effect performance differentially. The four possible locations for the four members of the inference set are on Both trials (the common cue), on only the First trial, on only the Second trial, or on Neither trial (the absent cue).

The mean number of errors given to the cue located on Both trials, First trial, Second trial, or Neither trials was 2.62, 1.04, 1.45, and 1.47, respectively. The mean number of errors per cue location as a function of sex is shown in Figure 1.

Another 2x2x2x2x4 analysis of variance was performed with Location replacing Type of problem as the last variable. The number of errors given to each of the four


MEAN NUMBER OF ERRORS
1.75
1.50
1.25
1.00
.75
.50
SEX
M
F
Both Trials
First Trial
Second Trial
Neither Trial
CUE LOCATION

locations was found to differ significantly ($F(3,192) = 12.3$, $p = < .001$) and the interaction between number of errors and sex of the subject was also found to be significant ($F(3,192) = 2.84$, $p < .05$). It should be pointed out, moreover, that in previous studies the cue which occurred on Neither trial has been reported as the most infrequently cited cue location. This finding was not obtained in the present study. As suggested in Figure 1 the males responses to the cue located on Both trials may be the source of the Sex x Location interaction variance.

Location of responses by type of problem.

In the previous analysis, location errors were summed over types of problems. It may be that location errors vary as a function of type of problem. In order to have four possible location responses for each type of problem so that comparisons could be made across types of problems, the responses to the correct location as well as incorrect locations for each type of problem were included in the present analysis. Thus, for each type of problem there was one correct location response and three incorrect location responses. The mean number of location responses for each type of problem summed over groups appears in Table 2.

The cue which occurred on both trials received the highest percentage of errors on the (−+) and the (+−)

Table 2

| Type of Problem | Both Trials | Response First Trial | Location Second Trial | Neither Trial |
|---|---|---|---|---|
| ++ | 4.59 | .44 | .54 | .40 |
| -+ | 1.20 | .25 | 4.09 | .44 |
| +- | .87 | 4.09 | .39 | .62 |
| -- | .55 | .31 | .61 | 4.51 |

problems (64% and 47%), but not on the (--) problem (37%) where the cue which occurred on the second trial received the highest percentage of the errors (41%).

Distribution of errors by relevant and irrelevant dimensions.

The original hypotheses were framed in terms of the creation of a pair relationship within each dimension through Training and stimulus Materials. It may be important to differentiate between errors in which the cue given was the incorrect value on the relevant dimension and errors which were either of the two values on the irrelevant dimension. This analysis may be accomplished through selective summation of error responses on each type of problem. For instance, with the (++) problem a "Neither Trial" cue location is an "Other value" error and "First Trial Only" and "Second Trial Only" cue locations are "Other dimension" errors. The total number of these two types of errors were summed over type of problem and the total for each training and Materials group were analyzed. Since there were two opportunities to make an "Other dimension" error and only one opportunity to make an "Other value" error, the two types of errors were analyzed separately. A summary of the mean number of errors of each type as a function of sex and of group may be seen in Table 3. Two (2(Training) x 2(Materials) x 2(Sex) analyses of variance were performed. The results

Table 3

| | | "Other" dimension | | "Other" value | | |
|---|---|---|---|---|---|---|
| | | Materials | | Materials | | |
| | | Opposites | Arbitrary | Opposites | Arbitrary | Mean |
| Trained | Male | 7.11 | 4.44 | 1.89 | 1.00 | |
| | Female | 3.22 | 3.33 | 1.33 | .44 | |
| | | | | | | 1.67 |
| Nontrained | Male | 7.33 | 5.22 | 2.33 | 1.67 | |
| | Female | 5.22 | 5.11 | 1.56 | .22 | |
| | | | | | | 1.94 |
| Mean | Male | 6.02 | | | | |
| | Female | 4.22 | | | | |

of these analyses are shown in Table 6 and Table 7 of Appendix B.

The only significant effect for the number of "other dimension" errors was Sex ($F(1,64) = 4.80$) $p = < .05$), a factor to be significant in the analysis of the overall error rate. The only significant main effect for the number of "other value" errors was Training ($F(1,64) = 4.90$, $p = < .05$). The Non-Trained Groups were more likely than the Trained groups to give the incorrect value on the correct dimension.

## Discussion

The creation of a pair relationship between the two values on a dimension, either through training or through use of natural opposites stimulus materials did not have the effect on performance in the inference task that was predicted. However, the training procedure did have some effect on the inference problem; the results of the present study were in the hypothesized direction and the training did prove effective in reducing the likelihood of an error occurring on the same dimension as the correct cue. In contrast, type of stimulus materials did not affect performance in the direction predicted and thus the use of materials consisting of opposites would seem important as a means of improving performance in future studies.

There were three significant main effects for errors; Trial Block, Sex of Subject and Type of Problem, but only performance as a function of Type of Problem is of major interest in the present discussion.

Contrary to the findings of most previous studies, the performance on the (++) and the (--) problems were significantly better than performance on the (-+) and the (+-) problems. Procedural differences between the present study and previous ones must be explored to determine whether such factors could have affected performance on the inference task.

There were two major procedural differences which may distinguish the present study from most of the others (Scholnick, 1970, 1971a, 1971b, 1971c; Daehler, 1972) and which, is combination, may have been the facilitating factor for the (++) and the (--) problems. First of all, in the present study the subject was positioned in front of a permanent array displaying all of the instances in the inference set. Secondly, information about the presence or absence of the correct cue on a trial was presented in a manner which emphasized the location of the correct cue.

Previous studies have varied the availability of cues by providing a list of the members of the inference set (Scholnick, 1971a), or by providing a response panel (Daehler, 1972). Through all of the cues may have been made available by these experimenters, the description of the position of

the cues in relationship to the subject is unclear in Scholnick's studies. In Daehler's study the members of the inference set were located to the side of the subject rather than in front of the subject. However, simply placing the entire inference set array in front of the subject may not have been the only factor which helped performance on the (--) problems. Instructions which emphasize the location of the correct cue may also have been helpful in directing the subject's attention to the repeated cue in the stimulus array and to the absent cue which was only available in the response array.

In the present study the location of the correct cue was emphasized by the experimenter. In most previous studies, instructions were phrased in terms of identification of the one of the four instances which was either the one the experimenter was "thinking about" or the one which "turns on the light." In this study if the correct cue was present on a trial the experimenter would then place a card which read "Yes" and say, "Yes, I can see my secret card ( the correct cue) here." If the correct cue was not present the experimenter would then place a card reading "No" on the trial and say, "No, I don't see my secret card here." This was done for each trial. The "Yes" implies that the correct answer is located on the trial presented. When Trial One and Trial Two are both "Yes" or both "No"

those implications are consistant and there is anecdotal evidence that consistant implications may be preferred by the subjects. Subjects often offered a hope that the next problem would be a "No" and a "No" (--) saying, "that's easy, it's the one that's not there (in the stimulus array)." Or, just as often they would volunteer a hope that the next problem would be a "Yes" and a "Yes" saying, "that's easy, since it's the one that's there and there (pointing to the Trial One and Trial Two areas in the stimulus array)." The subject may acquire the skill of looking to the response panel, which was readily available, to find the correct answer when he was told that it was not showing the stimulus array. The "Yes" on both trials gave the child consistant information that the answer was not showing in the stimulus array. In any case, the children found the (++) and the (--) to be the most easily solved and seemed to wish all of the problem were like them.

If the subject is attempting to use a simple strategy of trying to locate the positive cue in the stimulus array or in the response array, the mixed instances problems provide a situation of contradictory information for him. Therefore the consistency of information may be expecially important when direction of attention is conveyed, i.e. the cue is "there" or "not there" in the stimulus array. When one trial shows the correct cue and the other does not, the child's attention is not consistently directed to either

the stimulus array or the response array and the performance on those problems may suffer, or in other words, the child doesn't seem to integrate conflicting information.

This interpretation may gain added support from a re-examination of the data reported by Scholnick in a recent experiment (1971b). One group of 5 and 7-year-olds in that study was given instructions which indicated where the correct answer could be "found" and, in addition, required subjects to repeat the locational cues prior to offering a solution. For example, for a (++) problem the experimenter would say, "I'm going to tell you where something can be found. It's here and it's here." (While pointing to the appropriate trials). She then had the subjects repeat the location information by asking, "Where is it?" The mean number of errors made on the (++), (+-), and (--) problems using these instructions was 0.94, 1.19, 1.44, and 0.82 respectively. The relative ordering of the problems is similar to the present study in that(++) and (--) problems were easier than (-+) and (+-) problems. In Scholnick's study and in the present study inference set availability and, most importantly, attention directing information may have encouraged the development and employment of simple location strategies and yielded results contradictory to those previously observed.

When the four attributes of the inference set are chosen from one dimension there is no difference in per-

formance among the four types of problems (Daehler, 1972). Moreover, in a task involving two dimensions, but where the cues from one dimension are presented on Trial One so that one dimension can be eliminated early in the problem, the (--) problem is as easy to solve as the (++) and the (+-) problems. The present study's increased emphasis on the perceptual cues in the stimulus array and response panel may have produced a situation in the (++) and the (--) problems similar to Daehler's one dimension problems. That is, emphasis on location may reduce the importance of dimensionality for solution of the problem.

It has been suggested throughout this discussion that the subject's search for solution to the (++) problems is in the stimulus array and for the (--) problem the response array. The (++) problem has a simple solution not dependent on inference involving use of dimensional aspects of the cues, that is, if the answer is on Trial One and on Trial Two, the answer is simply the twice appearing cue. The (--) problem also has a simple solution which is not dependent upon dimensions, but is dependent on the elimination of all attributes on the response panel that were previously seen in the stimulus array. With consistent information, the subject may concentrate on one location and this may reduce the influence of two binary dimensions. Consideration of one four-itemed category may encourage a simple perceptual solution. The strategies developed for coping with

the unidimensional situation would be interesting to discover in future research. One method may be to vary the type of information the subjects receive in the indication of the presence or absence of the positive cue. The emphasis on location implied in the information has been shown to have some determining influence on the strategy used in at least two of the problems in this study.

In conclusion, the child exhibits remarkable sensitivity to procedural differences by development of strategies to use in each situation. The development of a complex strategy may depend upon the situation's requirement for for such a strategy. In this study, for example, the subject was told whether he was right or wrong on a problem and then shown the correct cue. He may have used the perceptual aspects of the experimental situation in discovering the simplest strategy to get the right answer. The use of the simple strategies, already discussed, produced correct answers on two of the four problems. However, in Scholnick's studies, the subject does not know whether he has given correct answers on any of the problems. The subject received no feedback. Therefore, he is not encouraged to develop a solution strategy for the problems. He is instead required to deal with four situations (i.e., types of problems) in the most consistent manner; possibly choosing his guess on the basis of its availability in the prominent stimulus array. The requirement for a cor-

rect solution does not guarentee usage of the given information to infer relevance any more than a non-directive situation because neither produce equal performance on the four types of problems. The four types of problems have not been solved with equal facility due to procedural influences. So, it is clear that in future studies using the inference task, the multiplicity of strategies implied by subtle variations in procedural variables should be evaluated and considered prior to interpretations of performance on the inference task.

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Footnotes

[1]It should be noted that Scholnick draws this conclusion although a close examination of performance from her 1971a study are not totally in support of its generality. Overall mean performance by just the seven year olds did not indicate that the (++) problem was the easiest to solve, instead, the (-+) problem had the lowest mean number of errors. In addition, Daehler (1972) has used a concept identification task to study inference and has also found -+ problems to be easier than ++ problems for seven and eight year olds. Thus, the generality of this age shift remains open to question. Even so, some bias toward either the constant or changed dimension cannot be ruled out as a source of errors on the inference task.

[2]The inference set is similar to the conjunctive concept example on Page Two but Scholnick required identification of only a single attribute.

[3]The author wishes to thank the Superintendent of the Belchertown, Massachusetts schools and the principal of the Cold Spring School for their help and cooperation.

Summary

This experiment investigated the influence of dimensional materials on the child's ability to solve four types of problems. The problems were derived from the four possible combinations of positive and/or negative instances in a two-trial concept identification problem. Earlier use of dimensional material had found the problem with only negative instances (--) to be the most difficult of the four to solve. It was proposed that if the two values on a dimension were established as highly associated and the only two values for the dimension, the availability of the correct alternative on the (--) problem would be enhanced. The results were inconsistent with the prediction. Instead of a discussion phrased in terms of the child's ability to transform negative instances to positive, the results are explained in terms of the present study's procedural differences. The information given to the subject put an emphasis on the location of the correct answer. The formation of many solution strategies in response to minor procedural variations was stressed in discussion of the results of the present study. Since children are sensitive to minor procedural variations and produce varying strategies, care should be exercised in future use of the inference task situation.

# APPENDIX A

Figure 1: The Natural Opposites stimulus materials.

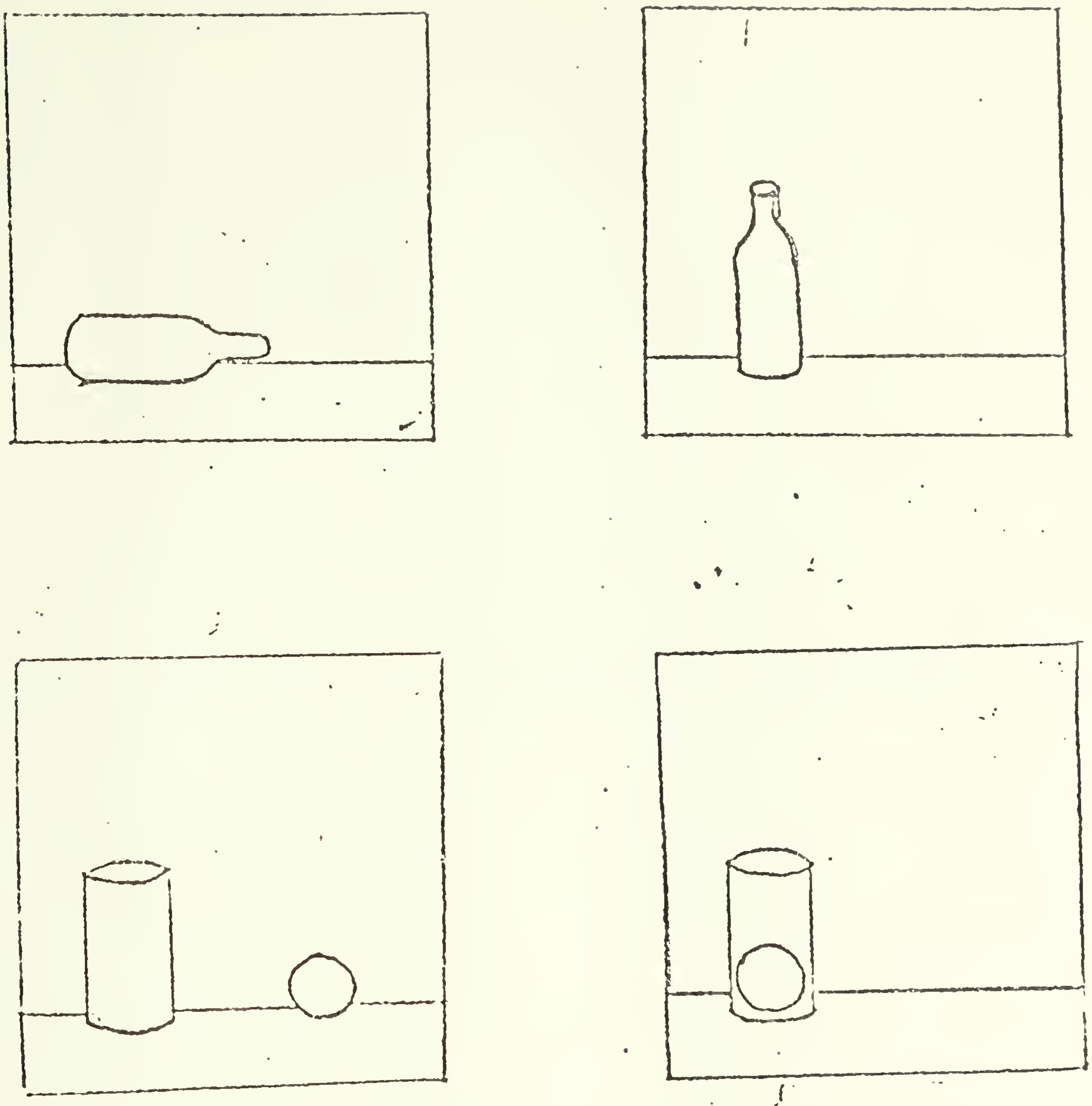


FIGURE 1

Figure 2: The Arbitrary stimulus materials.

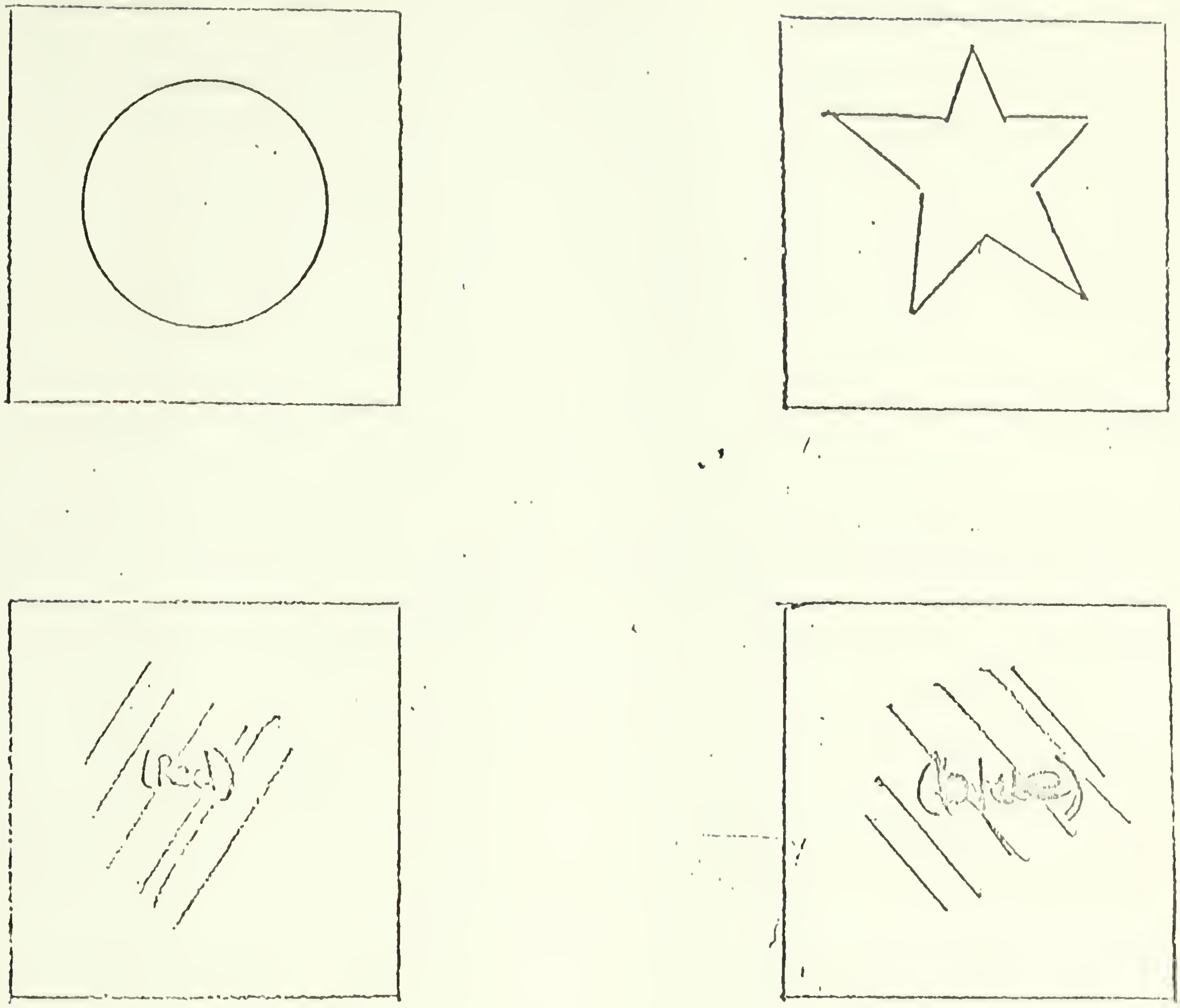
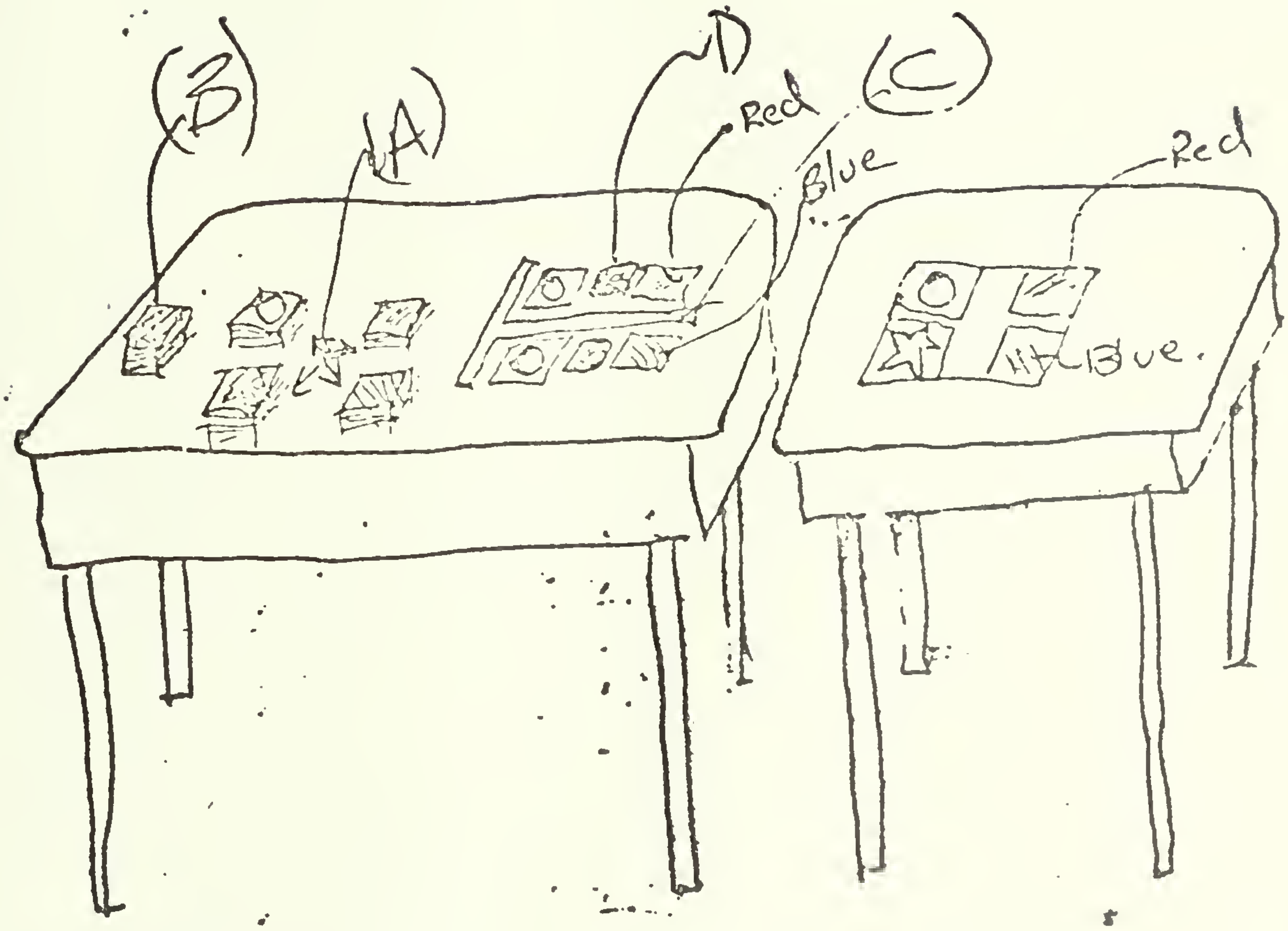



FIGURE 2

Figure 3: A typical experimental set up for the (+-) problem.


(B)
(A)
D
(C)
Red
Blue
Red
Blue.

# APPENDIX B

Table 1

T = 1  M = 1  X = 1  P = 1  TRAINED OPPOSITES MALES

| B = Birds | 1 | 2 | |
|---|---|---|---|
| L (LOCATING) = 1 BOTH | 2.00000 | 2.22222 | ++ |
| 2 FIRST | 0.22222 | 0.33333 | |
| 3 SECOND | 0.77778 | 0.44444 | |
| 4 NEITHER | 0.00000 | 0.00000 | |

T = 1  M = 1  X = 1  P = 2

| B = | 1 | 2 | |
|---|---|---|---|
| L = 1 | 0.88889 | 0.66667 | |
| 2 | 0.22222 | 0.33333 | −+ |
| 3 | 1.66667 | 1.88889 | |
| 4 | 0.22222 | 0.11111 | |

T = 1  M = 1  X = 1  P = 3

| B = | 1 | 2 | |
|---|---|---|---|
| L = 1 | 0.77778 | 0.55556 | |
| 2 | 1.66667 | 1.77778 | +− |
| 3 | 0.22222 | 0.11111 | |
| 4 | 0.33333 | 0.55556 | |

T = 1  M = 1  X = 1  P = 4

| B = | 1 | 2 | |
|---|---|---|---|
| L = 1 | 0.88889 | 0.11111 | |
| 2 | 0.00000 | 0.55556 | −− |
| 3 | 0.33333 | 0.22222 | |
| 4 | 1.77778 | 2.11111 | |

T = 1  M = 1  X = 2  P = 1  TRAINED OPPOSITES FEMALES

| B = | 1 | 2 | |
|---|---|---|---|
| L = 1 | 2.55556 | 2.44444 | |
| 2 | 0.11111 | 0.11111 | ++ |
| 3 | 0.22222 | 0.33333 | |
| 4 | 0.11111 | 0.11111 | |

T = 1  M = 1  X = 2  P = 2

| B = | 1 | 2 | |
|---|---|---|---|
| L = 1 | 0.77778 | 0.22222 | |
| 2 | 0.22222 | 0.00000 | −+ |
| 3 | 1.77778 | 2.77778 | |
| 4 | 0.22222 | 0.00000 | |

T = 1  M = 1  X = 2  P = 3

| B = | 1 | 2 | |
|---|---|---|---|
| L = 1 | 0.11111 | 0.00000 | +− |
| 2 | 1.88889 | 2.44444 | |
| 3 | 0.55556 | 0.33333 | |
| 4 | 0.44444 | 0.22222 | |

T = 1  M = 1  X = 2  P = 4

| B = | 1 | 2 | |
|---|---|---|---|
| L = 1 | 0.22222 | 0.00000 | |
| 2 | 0.33333 | 0.00000 | −− |
| 3 | 0.11111 | 0.22222 | |
| 4 | 2.33333 | 2.77778 | |

Table 2

T = 1 M = 2 X = 1 P = 1

TRAINED ARBITRARY MALES

| L | B = BLOCK 1 | 2 |
|---|---|---|
| 1 BOTH | 2.33333 | 2.44444 |
| 2 FIRST | 0.11111 | 0.33333 |
| 3 SECOND | 0.22222 | 0.11111 |
| 4 NEITHER | 0.33333 | 0.11111 |

+ +

T = 1 M = 2 X = 1 P = 2

| L | B = 1 | 2 |
|---|---|---|
| 1 | 0.88889 | 0.66667 |
| 2 | 0.11111 | 0.00000 |
| 3 | 2.00000 | 2.33333 |
| 4 | 0.00000 | 0.00000 |

− +

T = 1 M = 2 X = 1 P = 3 .

| L | B = 1 | 2 |
|---|---|---|
| 1 | 0.77778 | 0.33333 |
| 2 | 2.11111 | 2.33333 |
| 3 | 0.00000 | 0.11111 |
| 4 | 0.11111 | 0.22222 |

+ −

T = 1 M = 2 X = 1 P = 4

| L | B = 1 | 2 |
|---|---|---|
| 1 | 0.33333 | 0.11111 |
| 2 | 0.11111 | 0.22222 |
| 3 | 0.33333 | 0.00000 |
| 4 | 2.22222 | 2.66667 |

− −

T = 1 M = 2 X = 2 P = 1

TRAINED ARBITRARY FEMALES

| L | B = 1 | 2 |
|---|---|---|
| 1 | 2.22222 | 3.00000 |
| 2 | 0.22222 | 0.00000 |
| 3 | 0.55556 | 0.00000 |
| 4 | 0.00000 | 0.00000 |

+ +

T = 1 M = 2 X = 2 P = 2

| L | B = 1 | 2 |
|---|---|---|
| 1 | 0.44444 | 0.44444 |
| 2 | 0.11111 | 0.00000 |
| 3 | 2.22222 | 2.55556 |
| 4 | 0.22222 | 0.00000 |

− +

T = 1 M = 2 X = 2 P = 3

| L | B = 1 | 2 |
|---|---|---|
| 1 | 0.66667 | 0.11111 |
| 2 | 2.11111 | 2.77778 |
| 3 | 0.11111 | 0.00000 |
| 4 | 0.11111 | 0.11111 |

+ −

T = 1 M = 2 X = 2 P = 4

| L | B = 1 | 2 |
|---|---|---|
| 1 | 0.11111 | 0.11111 |
| 2 | 0.22222 | 0.00000 |
| 3 | 0.22222 | 0.00000 |
| 4 | 2.44444 | 2.88889 |

− −

Table 3

NON-TRAINED OPPOSITES MALES

T = 2 M = 1 X = 1 P = 1 ++

| L (LOCATION) | B = 1 | B = 2 |
|---|---|---|
| 1 BOTH | 2.00000 | 2.55556 |
| 2 FIRST | 0.33333 | 0.00000 |
| 3 SECOND | 0.33333 | 0.33333 |
| 4 NEITHER | 0.33333 | 0.11111 |

T = 2 M = 1 X = 1 P = 2 −+

| L | B = 1 | B = 2 |
|---|---|---|
| 1 | 0.88889 | 1.44444 |
| 2 | 0.44444 | 0.11111 |
| 3 | 1.22222 | 1.33333 |
| 4 | 0.44444 | 0.11111 |

T = 2 M = 1 X = 1 P = 3 +−

| L | B = 1 | B = 2 |
|---|---|---|
| 1 | 0.77778 | 0.22222 |
| 2 | 1.44444 | 2.00000 |
| 3 | 0.33333 | 0.33333 |
| 4 | 0.44444 | 0.44444 |

T = 2 M = 1 X = 1 P = 4 −−

| L | B = 1 | B = 2 |
|---|---|---|
| 1 | 0.44444 | 0.22222 |
| 2 | 0.33333 | 0.11111 |
| 3 | 0.88889 | 0.44444 |
| 4 | 1.33333 | 2.22222 |

NON-TRAINED OPPOSITES FEMALES

T = 2 M = 1 X = 2 P = 1 ++

| L | B = 1 | B = 2 |
|---|---|---|
| 1 | 2.00000 | 2.44444 |
| 2 | 0.11111 | 0.33333 |
| 3 | 0.44444 | 0.11111 |
| 4 | 0.44444 | 0.11111 |

T = 2 M = 1 X = 2 P = 2 −+

| L | B = 1 | B = 2 |
|---|---|---|
| 1 | 0.66667 | 0.33333 |
| 2 | 0.00000 | 0.11111 |
| 3 | 2.00000 | 2.33333 |
| 4 | 0.33333 | 0.22222 |

T = 2 M = 1 X = 2 P = 3 +−

| L | B = 1 | B = 2 |
|---|---|---|
| 1 | 0.66667 | 0.44444 |
| 2 | 2.00000 | 2.11111 |
| 3 | 0.22222 | 0.11111 |
| 4 | 0.11111 | 0.33333 |

T = 2 M = 1 X = 2 P = 4 −−

| L | B = 1 | B = 2 |
|---|---|---|
| 1 | 0.11111 | 0.55556 |
| 2 | 0.11111 | 0.00000 |
| 3 | 0.55556 | 0.44444 |
| 4 | 2.22222 | 2.00000 |

Table 4.

T = 2 M = 2 X = 1 P = 1 ++

NON-TRAINED ARBITRARY MALES

| | B = BLOCK 1 | 2 |
|---|---|---|
| L = 1 BOTH | 2,11111 | 2,55556 |
| 2 FIRST | 0,55556 | 0.11111 |
| 3 SECOND | 0,11111 | 0.00000 |
| 4 NEITHER | 0,22222 | 0,33333 |

LOCATION

T = 2 M = 2 X = 1 P = 2 − +

| B = | 1 | 2 |
|---|---|---|
| L = 1 | 0,33333 | 0,44444 |
| 2 | 0.00000 | 0.00000 |
| 3 | 2,11111 | 2,11111 |
| 4 | 0,55556 | 0,44444 |

T = 2 M = 2 X = 1 P = 3 + −

| B = | 1 | 2 |
|---|---|---|
| L = 1 | 0,44444 | 0,55556 |
| 2 | 2,22222 | 1.88889 |
| 3 | 0,11111 | 0,22222 |
| 4 | 0,22222 | 0,33333 |

T = 2 M = 2 X = 1 P = 4 − −

| B = | 1 | 2 |
|---|---|---|
| L = 1 | 0,44444 | 0,44444 |
| 2 | 0,22222 | 0,00000 |
| 3 | 0,66667 | 0.11111 |
| 4 | 1,66667 | 2,44444 |

T = 2 M = 2 X = 2 P = 1 ++

NON-TRAINED ARBITRARY FEMALES

| B = | 1 | 2 |
|---|---|---|
| L = 1 | 1,44444 | 2,44444 |
| 2 | 0,33333 | 0,33333 |
| 3 | 0,44444 | 0,00000 |
| 4 | 0,77778 | 0,22222 |

T = 2 M = 2 X = 2 P = 2 − +

| B = | 1 | 2 |
|---|---|---|
| L = 1 | 0,22222 | 0,33333 |
| 2 | 0,33333 | 0,00000 |
| 3 | 2,22222 | 2,22222 |
| 4 | 0,22222 | 0,44444 |

T = 2 M = 2 X = 2 P = 3 + −

| B = | 1 | 2 |
|---|---|---|
| L = 1 | 0,55556 | 0.11111 |
| 2 | 1,55556 | 2,44444 |
| 3 | 0,33333 | 0,00000 |
| 4 | 0.55556 | 0,44444 |

T = 2 M = 2 X = 2 P = 4 − −

| B = | 1 | 2 |
|---|---|---|
| L = 1 | 0,22222 | 0,11111 |
| 2 | 0,33333 | 0.00000 |
| 3 | 0,33333 | 0,00000 |
| 4 | 2,11111 | 2,88889 |

Table 5

| | | | Opposites | | | | Arbitrary | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Type of Problem | | | | Type of Problem | | | | overall mean |
| | Sex | Block | ++ | −+ | +− | −− | ++ | −+ | +− | −− | |
| Trained | Male | 1 | 1.00 | 1.33 | 1.33 | 1.22 | .67 | 1.00 | .89 | .78 | 1 M 1.02 |
| | | 2 | .79 | 1.11 | 1.22 | .89 | .56 | .67 | .67 | .33 | 2 .78 |
| | Female | 1 | .44 | 1.22 | .78 | .67 | .78 | .78 | .89 | .56 | 1 F 1.76 |
| | | 2 | .56 | .22 | .22 | .22 | .00 | .44 | .22 | .11 | 2 2.25 |
| | | Mean | .69 | .97 | .89 | .75 | .50 | .72 | .67 | .44 | .70 |
| Nontrained | Male | 1 | 1.00 | 1.78 | 1.56 | 1.67 | .89 | .89 | .78 | 1.33 | 1 M 1.24 |
| | | 2 | .44 | 1.67 | 1.00 | .78 | .44 | .89 | 1.11 | .56 | 2 2.86 |
| | Female | 1 | 1.00 | 1.00 | 1.00 | .78 | 1.56 | .78 | 1.44 | .89 | 1 F 1.05 |
| | | 2 | .56 | .67 | .89 | 1.00 | .56 | .78 | .56 | .11 | 2 .64 |
| | | Mean | .75 | 1.28 | 1.11 | 1.05 | .86 | .83 | .97 | .72 | .94 |
| | | Overall mean | .72 | 1.25 | 1.00 | .90 | .68 | .78 | .81 | .58 | |
| | | Combined materials | .70 ++ | .95 −+ | .91 +− | .74 −− | | | | | |

Table 6

| Source | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Materials (M) | 25.6806 | 1 | 25.6806 | 2.10 | |
| Training (T) | 25.6806 | 1 | 25.6806 | 2.10 | |
| Sex (X) | 58.6806 | 1 | 58.6806 | 4.80 | .05 |
| MT | 0.1250 | 1 | 0.1250 | | |
| MX | 25.6806 | 1 | 25.6806 | 2.10 | |
| TX | 8.6806 | 1 | 8.6806 | | |
| MTX | 0.6806 | 1 | 0.6806 | | |
| S(MTX) | 782.6667 | 64 | 12.2292 | | |

Table 7

| Source | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Materials (M) | 3.5556 | 1 | 3.5556 | 1.61 | |
| Training (T) | 10.8889 | 1 | 10.8889 | 4.95 | .05 |
| Sex (X) | 2.0000 | 1 | 2.0000 | | |
| MT | 3.5556 | 1 | 3.5556 | 1.61 | |
| MX | 2.0000 | 1 | 2.0000 | | |
| TX | 0.8889 | 1 | 0.8889 | | |
| MTX | 2.0000 | 1 | 2.0000 | | |
| S(MTX) | 140.8889 | 64 | 2.2014 | | |