LOYOLA eCOMMONS

Loyola University Chicago
Loyola eCommons

Dissertations

Theses and Dissertations

1987

Individual Differences in Strategy Shift on a Perceptual Classification Task

Cathleen Campbell-Raufer
Loyola University Chicago

Follow this and additional works at: https://ecommons.luc.edu/luc_diss

Part of the Psychology Commons

Recommended Citation

Campbell-Raufer, Cathleen, "Individual Differences in Strategy Shift on a Perceptual Classification Task" (1987). *Dissertations*. 2543.
https://ecommons.luc.edu/luc_diss/2543

This Dissertation is brought to you for free and open access by the Theses and Dissertations at Loyola eCommons. It has been accepted for inclusion in Dissertations by an authorized administrator of Loyola eCommons. For more information, please contact ecommons@luc.edu.

This work is licensed under a Creative Commons Attribution-Noncommercial-No Derivative Works 3.0 License.
Copyright © 1987 Cathleen Campbell-Raufer

INDIVIDUAL DIFFERENCES IN STRATEGY SHIFT ON A PERCEPTUAL CLASSIFICATION TASK

by

Cathleen Campbell-Raufer

A Dissertation Submitted to the Faculty of The Graduate School of Loyola University of Chicago in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

December

1987

(c) 1987, Cathleen Campbell-Raufer

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The author wishes to thank Fr. Dan O'Connell for his continued advocacy of this research, for his useful comments pertaining to the organization and structure of the text, and for his unflagging editorial contributions. Thanks are also extended to Dr. Gene Zechmeister for sharing his expertise in the area of statistical analysis, and for his indispensable advice regarding the theoretical and practical interpretation of the findings. Dr. Jill Reich's suggestions concerning the formulation and implementation of this study are likewise gratefully acknowledged.

The author also wishes to thank her family for their support and encouragement throughout the development of this dissertation.

VITA

The author, Cathleen Campbell-Raufer, is the daughter of Sherell Eugene Campbell and Mary Ann (Marchese) Campbell. She was born August 1, 1957 in Chicago, Illinois.

Her elementary education was obtained in the parochial schools of Rolling Meadows, Illinois, and secondary education at Rolling Meadows High School, where she graduated in 1975.

In August, 1975, she entered Illinois State University, and in December, 1978, received the degree of Bachelor of Science with a major in psychology.

In September, 1979, she was granted an assistantship in experimental psychology at Loyola University of Chicago, enabling her to complete the Master of Arts in 1982.

LIST OF TABLES

LIST OF FIGURES

CONTENTS FOR APPENDICES

INTRODUCTION

When individuals are asked to classify perceptual stimuli, their response patterns may reflect a reliance on some aspects of the stimulus to the exclusion of others. If the stimuli have been constructed in a certain way, the classifications will indicate the individual's underlying strategy or mode of information processing. This strategy will be utilized until the demands of the task change, or until some maturational or experiential factors allow the individual to develop and use other strategies.

One reason individuals use one strategy exclusively may be that they are unaware of the availability of other strategies. If choice of strategy results from a lack of awareness of these options and not from ability, then overtly providing people with other strategies may make them shift to the processing mode that is more often used by older, more experienced individuals.

The present study sought to examine the effect of such instructions on the methods individuals use to classify perceptual stimuli. Whether strategy shifts indicate a greater ability to utilize various strategies or merely indicate increased awareness of strategy options could thus be determined. Also of interest was how complete a strategic description was necessary before a strategy shift occurred for a significant number of individuals.

REVIEW OF RELATED LITERATURE

Cognitive strategies have been well researched in both the verbal and spatial domains. Investigations of cognitive strategies have sought to answer three general questions. The first question has to do with how a strategy is defined. The second question concerns how individuals differ in their choice of strategy. The third question addresses those circumstances under which individuals shift strategies.

General Description of a Strategy

Rigney (1978) believes a strategy is composed of two parts, one component which specifies how information will be utilized, and another which consists of the cognitive processes through which that information is transformed. Kail and Bisanz (1982) consider strategies to be flexible rather than reflexive in nature. They thus can be modified to become more adaptive to the goals of the task. Sternberg (1984) describes a strategy as a particular way of selecting and combining the elementary information processes that actually execute a task. In general, a strategy can be defined as the rule or plan which guides performance on a task.

Variety of Available Strategies

Studies conducted in the spatial domain have enabled researchers to specify more exactly what constitutes a successful spatial strategy and how individuals differ in strategic preference. Barratt (1953) examined the verbal reports of subjects performing spatial tasks and found that they could be classified as either using familiar objects as referents or using abstract symbolism. Barratt was also able to distinguish between an approach that emphasized the whole figure and an approach that emphasized the part. Those subjects using the part approach scored significantly higher on tests involving mental rotation.

Cooper (1976) found similar individual differences in performance on spatial tasks. Subjects were asked to compare a standard shape with one of seven distractors varying in similarity from the standard. Two types of subjects were found. Type I subjects responded more quickly when the shape and distractor were the same, and their speed of 'different' responses was unaffected by the shapes' similarity. For Type II subjects, 'different' responses were faster than 'same' responses, and 'different' reaction time decreased with greater differences between the standard and the distractor. Cooper (1976) believes Type I subjects employ a holistic strategy, whereas Type II subjects employ a dual-process strategy, using a holistic comparison process for 'same' responses and a feature omparison process for 'different' responses.

Witkin (1950) found that subjects fall into two main categories of perceptual tendency when solving embedded figures-type problems. Successful (or field-independent) subjects use an analytic approach characterized by concentrating on one outstanding feature of the figure rather than the whole figure. Less successful (or field-dependent) subjects also tried this approach but were less able to follow through with it because of interference from other parts of the figure.

Hock, Gordon, and Marcus (1974) classified subjects as either analytic or structural on the basis of their performance on a mental rotation task. There are reliable individual differences in the ability of subjects to rotate a familiar figure into an unfamiliar orientation. Analytic subjects demonstrate small rotation effects; structural subjects yield large rotation effects. Having thus classified the subjects into processing types, the researchers administered an embedded figures-type test. The results indicated that analytic subjects were able to find the embedded figures more quickly than the structural subjects.

These processing differences can extend beyond the spatial domain. Spiro and Tiree (1980) examined differences in style on an embedded figures test and how these differences relate to the extent to which subjects use knowledge schemata when remembering parts of a narrative. They found that those subjects who demonstrated greater spatial ability on the embedded figures test were better able to use the knowledge schemata efficiently and thus were better able to remember food items from a restaurant narrative where schemata were relevant, than from a grocery store narrative where they were not relevant. Lower scoring subjects on the embedded figures test remembered the restaurant and grocery store food items equally well. Thus, the subjects' ability to impose structure on the spatial task is related to their ability to use the inherent structure of the restaurant narrative to help them remember the food items.

Individual differences were also examined by MacLeod, Hunt, and Mathews (1978) using a modification of the sentence-picture verification task. Subjects were instructed to view the comparison sentence for as long as they needed and then push a button to indicate they were ready for the picture to be presented. This 'comprehension time' was recorded. Time to respond true or false, or 'verification time', was also recorded. Two groups of subjects were isolated: those consistently using a linguistic strategy and those using a pictorial-spatial strategy.

MacLeod et al., (1978) believe that subjects using the linguistic strategy change the picture representation to sentence form within the verification time segment, while subjects using the pictorial-spatial strategy convert the sentence representation to picture form within the comprehension time segment. In addition, subjects' choice of strategy could be predicted from psychometric tests of verbal and spatial ability which had been administered two years prior to the experiment. Subjects using the pictorial-spatial strategy demonstrated markedly higher spatial ability. Thus, subjects seem to choose the strategy which taps their cognitive strengths.

Overall, there are consistent individual differences in the strategies used on most spatial tasks. Subjects' choice of strategy may involve both information processing abilities and individual preferences.

Factors Affecting Strategy Shift

If Battig (1979) is correct in his assumption that multiple strategies enhance performance, then a more powerful predictor of successful problem solving would include the ability of the subject to shift strategies with changing task demands or with increased exposure to the task. Witkin and Goodenough (1981), for example, state that while field-independent and field-dependent cognitive styles are the patterns commonly found, they are not the only patterns to be found, and that once present they may be changed. People who consistently exhibit either field-independent or field-dependent styles can be regarded as fixed; whereas individuals who have access to the characteristics associated with both styles can be regarded as mobile. According to Witkin and Goodenough, mobility signifies greater diversity of functioning and is thus more adaptive. Battig has referred to this ability to shift strategies in response to changing task demands as cognitive flexibility.

A useful means of categorizing the factors which affect a strategy shift was provided by Foard and

Kemler Nelson (1984). According to these authors, changes in processing may be due to stimulus, task or subject effects.

Stimulus Factors. The restricted classification paradigm was originally described by Garner (1974) to study stimulus effects. Garner (1974) hypothesized that certain (i.e., integral) stimuli are preceived in terms of overall similarity; other (i.e., separable) stimuli are perceived with respect to their component dimensions. Thus, earlier studies by Garner and his colleagues (Garner, 1969, 1970, 1976; Garner and Flowers, 1969; Lockhead, 1966) tended to regard separability and integrality as stimulus attributes. Under this assumption, the research goal became one of attempting to determine how variation in these stimulus characteristics affected the speed and accuracy of discrimination. Individual differences, however, were found to be important (Garner & Felfoldy, 1970).

Monahan and Lockhead (1977) caution that, when discussing stimulus effects, we must take into account what is integral for the subject. For example, the horizontal and vertical lines comprising the letter "T" may be integral for an adult but not for a preschool child.

Task Factors. The effect of changing task demands upon a subject's subsequent choice of strategy has been well documented in the literature. Marton and Saljo (1976) attempted to induce different levels of processing by varying the types of questions (deep level vs. shallow level) they asked subjects. These experiementers had subjects read three incomplete chapters. The questions were asked between the second and third chapters. The subjects were then tested for short-term and long-term retention. Marton and Saljo found that what the subject classified as learning was dependent upon the context of the questions they asked. The subjects modified the way in which they approached the reading material to more closely approximate the processing level of the questions they were asked.

McDaniel and Kearney (1984) tested the effect of instructions on subjects' processing mode. Subjects were instructed to use either appropriate or inappropriate strategies and others were not instructed to use any particular strategy. McDaniel and Kearney found that uninstructed subjects spontaneously employed strategies that produced performance equal to that of the subjects given task-appropriate strategy instruction. Thus, subjects vary their processing across tasks in a task-appropriate fashion.

Strategy shifts were also studied by Simon and Reed (1976). They used the missionaries and cannibals task (in which subjects manipulate hypothetical individuals in a boat between two banks of a river with constraints upon the ratio of missionaries to cannibals and upon the weight capacity of the boat). Simon and Reed found that most subjects initially used strategies that were suggested by the constraints of the task. These initial strategies has to be abandoned because they did not lead to a solution. Providing subjects with experience or a hint in the form of a subgoal seemed to cause them to swtich more quickly to a better strategy.

Cooper (1980) directly tested flexibility by stystematically changing task demands and measuring the subject's subsequent changes or shifts in spatial information processing strategies. Cooper found that subjects can be quite flexible in their use of strategies when the circumstances of the task demand it.

Russo and Dosher (1983) determined subjects' strategy (holistic vs dimensional) for a binary choice problem using eye-fixation patterns. These patterns were shown to associate with the subject's preferred strategy through an extended verbal protocol analysis. Russo and Dosher contend that subjects keep track of the amount of mental effort that they are putting forth for each strategy and select a strategy which minimizes these mental effort costs while maximizing correct solutions. Thus, there are some strategies which require more effort than an individual is able to afford for a particular processing task.

Subject Factors. There are several factors which fall under the category of subject effects. One of these subject factors is impulsivity. That is, the speed with which a subject makes a classification affects the type of classification made. Ward (1983), while investigating the relationship between response tempo and type of processing, found support for the notion that holistic, integral processing precedes analytic, dimensional processing. Subjects classified as impulsive by an independent measure of cognitive style were more likely to emit a similarity (integral) response.

Experimental results reported by Monahan and Lockhead (1977) suggest that an analysis of the component properties on an integral stimular cannot occur before holistic processing. Thus, subjects may differ in the their tendency to respond on the basis of their initial holistic processing or may differ in the amount of time required to shift between processing modes.

Ashby and Townsend (1986), however, distinguish between perceptual and decisional separability. Ashby and Townsend believe subjects may be able to perceptually separate the crucial stimulus dimensions but reintegrate this information as they make their decision on how to respond. Overall, it seems that impulsivity is one way to conceptualize individual differences in dimensional processing.

Ward (1980) examined how the propensity to shift perceptual strategies changes during the course of an individual's development. He found that adults gave predominantly dimension-based responses while children based the majority of their responses to overall similarity. More importantly, adults tend to change their method of responding across trials, making more dimensional responses with increased exposure to the task. Children do not change their pattern of responding even though they seem to be aware of the dimensional nature of the stimulus.

Developmental differences were also discussed by Smith and Kemler Nelson (1984). They found that younger children rely almost exclusively on a holistic (integral) processing mode, while older children have access to either a holistic or an analytic (separable) mode of processing. Furthermore, when adults are tested under varying conditions of stress, they regress and become more childlike in their classifications. The authors suggest that similarity responding is a fallback rule which adults use when their normally predominant dimensional analysis is inappropriate.

While there are individual differences in the initial approach to a restricted classification task as well as differences in the propensity to shift strategies with exposure to the task, the cause of these individual differences remains undetermined. If individual differences are caused by underlying variation in perceptual ability, then knowledge of other strategies should have no appreciable effect on classification. If, instead, individual differences reflect only a lack of awareness of other available strategies, then information about a more advanced strategy should cause subjects to shift to that strategy.

Ward (1986) found that the performance differences exhibited between learning disabled and nondisabled children on a restricted classification task parallel those difference exhibited between younger and older children. More specifically, nondisabled children tended to produce less similarity responses (and more dimensional responses) as they got older. Learning disabled children did not change their level of similarity classification with age, especially to stimuli that varied on the dimensions of length and density.

In their study on the effects of music and alcohol on classification, Ward and Lewis (1987) noted that music helps sober adults to respond analytically but decreases analytic responding in intoxicated adults. Likewise, music tends to help older children be analytic, yet causes younger children to be less analytic. It seems that time pressure, alcohol, and other stressors can increase the effort necessary to make a dimensional response. At some level of stress, the effort required for a dimensional response is too great, just as it is too great for younger and learning disabled children.

In an attempt to relate individual differences in spatial processing to scores on psychometric tests of spatial ability, Ward (1985) employed the restricted classification task as well as the Group Embedded Figures Test (GEFT), a measure of spatial disembedding ability. Performance on the GEFT was predictive of whether the subject would increase dimensional responding with exposure to the stimuli. Thus, the psychometric test of spatial ability was an indication of the ability to learn perceptually, to discover the usefulness of the dimensional structure for classifying the items. The cause of these individual differences in the use of dimensionality, however, remains unspecified.

Smith and Baron (1981) believe the classification task measures the subject's tendency to respond to a dimensional manner rather than his or her ability to do so. Ward (1985) believes that integral perceivers are less able than dimensional respondents to break down the stimuli into components. Thus, it is unclear whether integral subjects would respond on the basis of dimensionality when aware of their ability to do so.

One way to investigate why some subjects increase their dimensional responding over trials would be to provide instructions of varying strength and specificity, and to compare the subsequent changes in processing with other subjects' spontaneous changes. If Witkin (1978) is correct in assuming that the individual differences associated with perceptual tasks of this type are representative of technique or strategy rather than ability, then instructing subjects to process the information in a certain (dimensional) way should diminish these individual differences. Thus, one variable of interest in the present experiment is how strong an instruction is necessary to produce a strategy shift toward more dimensional processing beyond that spontaneously produced in a group allowed to experience the task without instruction.

The manner in which stimulus dimensions of different salience are affected by task factors (such as instructions) is also of interest. Ward (1985) hypothesized that separable responding should be related to the ability to filter highly salient rather than less salient dimensions. This would seem a plausible explanation of why separable classifiers performed better on the GEFT; they show less interference from the more salient dimensions of color and overall form. Ward (1985) suggests further studies be conducted to determine how susceptibility to interference from more salient dimensions is related to performance on the restricted classification task.

In the present experiment, the stimulus dimensions of length and density were used. Since previous research (Ward, 1980, 1983, 1985) has shown density to be the more salient of these two dimensions (i.e., density is the dimension which is noticed first), a comparison can also be made between the more and less salient dimensions at each level of instruction strength. Thus, another variable of interest in the present experiment is whether the instructions will increase dimensional responding in the more salient dimension (density), in the less salient dimension (length), or in both.

Hypotheses

The purpose of this study was to determine the effect of instructions on the methods used to classify perceptual stimuli. Instructions of varying strength and specificity were tested. The instructions may be looked upon as a substitute for experience in performing the classiciation task, helping subjects to overcome their initial impulsivity in making the judgements. The stronger and more specific the instructions, the more quickly a shift toward more developmentally advanced processing should occur. Whereas classification style is a product of both ability and tendency, instructions should affect those individual differences caused by tendency or preference.

In the present experiment, the instructions ranged along a continuum of specificity. With regard to these task factors, it was hypothesized that specifically mentioning the length dimension would yield a greater increase in the number of dimensional responses (i.e., responses based solely on length) than would the indirect (analogous) instructions. Likewise, specifically mentioning the density dimension would yield more responses based solely on density than would the indirect instructions. In addition, the analogous instruction group was predicted to produce more dimensional responses than the (no instruction) control group. Thus, the analogous instructions were viewed as falling between specific instructions and normal experience on the task in terms of their capacity to cause a strategy shift.

With reference to the strength or completeness of the instructions, it was also hypothesized that the complete instructions (those which mentioned both relevant dimensions) would yield a greater increase in dimensional responses when summed across problem types than would instructions to use either single relevant dimension.

The third and final hypothesis concerned the saliency of the two dimensions involved in the task. With regard to this stimulus factor, it was predicted that these instructions would produce a greater increase in dimensional response to length items, since length is less likely to be discovered spontaneously.

METHOD

Subjects

The participants of this experiment were 156 undergraduate students who received course credit. The credit partially fulfilled the requirements of an introductory psychology course. Individuals were asked to volunteer for the experiement and the first 156 students who signed up were included. The median age was approximately 20 years and roughly equal numbers of females and males were included.

Materials

The materials consisted of stimuli similar to those used in the restricted classification task (Garner, 1974; Ward, 1983, 1985). In the restricted classification task, subjects are shown triads of stimuli and asked to choose the two that "go together best". Each member of the triad is a horizontal line composed of dots. Each line varies in dot density and line length.

The lines were chosen from the set of lines representing the possible combination of lengths of

1.25, 1.75, 2.5, 3.75, 5.0, 7.5 and 10.0 cm and of interdot distances of .125, .25, .40, .65, .85, 1.25 and 1.70 cm. These lengths correspond to 7, 9, 13, 19, 25, 37, and 49 spaces, respectively, of an elite typewriter. The interdot distances correspond to typing every 1/2, 1, 2, 3, 4, 6 and 8 spaces respectively, on an elite typewriter.

Twelve triads were constructed so that six of the triads had two lines that were identical in length and very different in density (a length triad), and six of the triads had two lines that were identical in density and very different in length (a density triad). All 12 triads had a third line that differed from the other two lines on both dimensions. This third line differed slightly (i.e., by only one level on each dimension) from one of the other lines. Thus, subjects could choose the pair of lines that was similar on two dimensions but not identical on either (a similarity or integral response), the pair that was identical on one dimension and very different on another (a dimensional or separable response), or the pair that was very different on both dimensions (a haphazard or anomalous response) (see Appendix A for an example of both a density and a length triad).

Three versions of each triad were constructed so that each line appeared once in the top, middle and bottom positions, yielding 36 total triads. One version of each triad was randomly chosen to appear in each trial block. The order of the triads was randomized by block and each subject received the same blocks in the same order. Thus, there were 36 items in all, 3 blocks of 12 items each.

The top, middle and bottom line of each triad were given the labels "A", "B", and "C," respectively. The lines of each triad were typed on index cards, using the period for the dot, and centered above each other. The index cards were photographed for presentation on a slide projector.

In addition, two pages of instructional exercises for each group were constructed. These were designed to inform the subjects of particular stimulus dimensions. Subjects in Group 1 were administered the length and density instruction, subjects in Group 2 were given the density-only instruction, and subjects in Group 3 were given the length-only instruction. Group 4 subjects were provided with instructions involving the two analogous dimensions of circle size and radius angle. Subjects in Group 5 were asked to complete a demographic questionnaire (see Appendix B for the instructions given to each group).

A two-page follow-up questionnaire containing one final density and length item was also constructed to measure the extent to which subjects were aware of the dimensional nature of the stimuli (see Appendix C for this follow-up questionnaire).

Procedure

Prior to the administration of the experiment, experimental conditions were randomly assigned for 150 subjects with the constraint that 30 subjects serve in each of the five experimental groups. At the beginning of the experiment, the subjects were given a 5-page response packet. The first page was the response form for the restricted classification task (see Appendix C for this form). The second and third pages were the instructional exercises which varied by group. The fourth and fifth pages were the questionnaire sheets given as a follow-up to all subjects. Since the order of the instructional exercises in the response packets had been previously randomly assigned, the experimenter did not know during the experiment the condition to which any subject was assigned.

The restricted classification task, instructional exercises and follow-up questionnaire were administered to 150 subjects in groups ranging in size from 1 to 10 individuals.

Prior to the restricted classification task, the subjects were told they would see 36 slides, 3 blocks of 12 slides each. They were told each slide contained three lines of dots (marked A, B and C). The subjects were asked, for each slide, to choose the two lines which they thought went together best and to write the letters of those two lines in the appropriate blanks on their answer sheet. Subjects were also told that between the first and second blocks they would be asked to complete two pages of exercises and that a questionnaire would be administered after the slide items. Following the instructions, the first block of 12 triads were presented. Each slide was presented for 8 seconds. Immediately following the first block of slides, the subjects were asked to complete the two pages of exercises which comprised the instruction portion of their response packet. Subjects were asked to turn to Page 2, complete the exercises on Pages 2 and 3, and turn back to Page 1 when they were finished. After all subjects had completed these exercises, the second block of triads was presented. Following the second block of triads, the subjects were told there would be a 1 minute rest period. All subjects sat quietly for 1 minute. The subjects were then presented with the third block of triads.

At the conclusion of the restricted classification task, all subjects were asked to complete the follow-up questionnaire as carefully as possible. The subjects were then debriefed and dismissed from the experimental session.

In order to more accurately describe how and when a strategy shift occurred, six additional subjects provided verbal reports upon which protocol analyses were conducted. These individually-tested subjects were asked to think aloud and to provide reasons for their choices of stimuli as they were presented with the triads. These subjects received the identical series of slides that the regular subjects received. Five of these six subjects were each given a different set of instructional exercises which corresponded to the five groups of regular subjects' instructions. A sixth subject, serving as an additional control, sat quietly for 1 minute following the first and second blocks. All six subjects were asked to respond orally to the follow-up questionnaire. A tape recording was made of the verbal reports accompanying the classification task, the instructional exercises and the follow-up questionnaire for these six subjects. These verbal reports were later coded into dimensional, similarity and haphazard categories. Additional comments were scrutinized for evidence of the subject's discrimination of one or both of the relevant dimensions.

RESULTS

General

An analysis of variance was performed on the number of dimensional (i.e., separable) responses with groups (1 to 5) as the between subjects variable and problem type (length or density) and trial block (1 to 3) as the within subjects variables. The test of the difference between groups was significant, F (4, 142) = 15.08, $p<.001$. There was also a main effect of trial block, F (2, 284) = 107.69, $p<.001$; as well as problem type, F (1, 142) = 28.66, $p<.001$; and a significant group by trial block by problem type interaction, F (8, 284) = 16.45, $p<.001$. The trial block by problem type interaction, however, was not significant, F (2, 284) = 1.77, $p>.17$.

Table 1 shows the number of dimensional, similarity and haphazard responses given to length and density items across the three trial blocks.

One subject in each of Groups 1, 2 and 4 was not included in the analysis because of missing data. Each of these three subjects failed to respond to one of the 36 slide items with which they were presented. Thus, there were 30 subjects in Groups 3 and 5 and 29 subjects in Groups 1, 2 and 4 available for the analysis.

Table 1

Number of Dimensional, Similarity and Haphazard Responses Given to Length and Density Items for the Five Groups

	LENGTH ITEMS					DENSITY ITEMS				
	Group					Group				
	1	2	3	4	5	1	2	3	4	5
Block 1 Response:										
Dimensional	74	48	93	33	42	108	86	102	85	98
Similarity	93	108	78	122	114	55	74	65	83	68
Haphazard	7	18	9	19	24	11	14	13	6	14
Block 2 Response:										
Dimensional	155	36	160	56	43	146	157	66	110	124
Similarity	17	124	14	109	124	20	6	107	57	49
Haphazard	2	14	6	9	13	9	11	7	7	7
Block 3 Response:										
Dimensional	161	42	166	84	69	161	148	87	122	136
Similarity	9	115	12	79	96	7	13	90	46	34
Haphazard	4	17	2	11	15	6	13	3	6	10

As can be seen in Table 1, there was greater variation among groups in the initial (Block 1) dimensional response levels for length items than for density items. To test this, an analysis of variance was performed on the Block 1 scores for length and density items across the five groups. A significant difference was found for length but not for density items. That is, for length items, there was a significant difference between groups in the number of dimensional responses given $\underline{F}$ (4, 145) = 20.06, $\underline{p} < .01$; in the number of similarity responses given $\underline{F}$ (4.145) = 3.30, $\underline{p} < .05$; and also in the number of haphazard responses given, $\underline{F}$ (4, 145) = 2.51, $\underline{p} < .05$. For density items, there was no significant difference between groups in the number of dimensional, $\underline{F}$ (4, 144) = 1.16, $\underline{p} > .32$; similarity, $\underline{F}$ (4, 144) = 1.36, $\underline{p} > .25$; or haphazard responses, $\underline{F}$ (4, 144) = 1.03, $\underline{p} > .39$.

Despite random assignment, the groups were significantly different in their initial (pretreatment) levels of responding to length items. An attempt was made to equate the groups on this pretreatment level. Since numerous studies have shown that integral processing precedes separable processing in development (Smith & Baron, 1981; Smith & Kemler Nelson, 1984; Ward

1980, 1986), in time (Ward, 1983), and in experience with the task (Ward, 1985), the strategy shift of interest was from integral to separable processing. Also, this experiement was originally designed to test the effects of the various instructions on subjects who tended originally to give fewer dimensional responses.

Therefore, in order to more closely approximate the subjects' initial strategy levels so that a strategy shift could be detected, only subjects demonstrating a predominantly integral strategy were of interest. Subjects already producing a majority on dimensional responses of the first trial block were excluded from subsequent analysis. Thus, only subjects making three out of six or fewer dimensional responses on Block 1 were included in further analysis. These subjects will be referred to as dimension-naive since they did not initially use a dimensional criterion on a majority of the items.

Since there was a significant difference in the subjects' responses to length and density items, separate analyses for these two problem types were performed. Subjects with three or less dimensional responses on Block 1 length items were analyzed separately from those making three or less dimensional responses to Block 1 density items.

Length Dimension-naive

Table 2 shows the percentage of the dimension-naive subjects in each group who made a dimensional response to each of the 18 length items. The block totals (in parentheses) represent the mean number of dimensional responses made to the six length items in each block. For example, subjects in Group 1 averaged about one dimensional response to the six length items in the first block of slides.

It can be seen from Table 2 that Groups 1 and 3 show a marked superiority on Block 2 dimensional response levels; Group 4 showed a modest improvement from Block 1 and Groups 2 and 5 did not change. This suggests that the instructions given to Groups 1 and 3 greatly improved their ability to use the dimensional aspect of the stimulus, while the treatment given to Group 4 had a moderate effect. These findings support the hypothesis that the instructions exist along a continuum of effectiveness. The indirect or analogous instructions (Group 4) produced a dimensional response which fell between the levels produced by the specific instructions (Groups 1 and 3) and the unstructed control (Group 5), at least for length items.

LEWIS TOWERS
LOYOLA
UNIVERSITY
LIBRARY

Table 2

Percentage of Dimensional Responses to Length Items Given by Subjects Dimension-naive on Block 1 Length Items

	Group 1	2	3	4	5
Item					
1	0	27	7	8	12
3	17	9	43	8	12
5	39	23	36	16	16
6	17	9	14	4	16
8	17	9	7	4	12
11	17	9	0	4	4
	(1.06)	(.86)	(1.07)	(.44)	(.72)
14	89	32	93	32	8
18	94	23	79	20	8
19	94	5	86	20	8
21	78	9	93	28	16
22	83	9	93	12	12
24	94	9	93	32	28
	(5.33)	(.86)	(5.36)	(1.44)	(.80)
25	94	14	93	36	32
28	78	23	86	48	24
29	100	14	93	56	32
30	83	18	93	40	28
35	94	23	79	32	24
36	89	18	86	44	24
	(5.39)	(1.09)	(5.29)	(2.56)	(1.64)

On Block 3, Groups 1 and 3 remained at their high level and Group 4 again improved moderately. Very little overall improvement was exhibited by Groups 2 and 5. The similar pattern of response to length items demonstrated by Groups 2 and 5 indicates that informing subjects about the density dimension did not produce a change in strategy relative to the control group.

Tables 3, 4 and 5 show the response patterns of these dimension-naive subjects broken down by the number of dimensional responses for Blocks 1, 2 and 3 respectively. For dimension-naive subjects, there was no significant difference on their Block 1 levels of dimensional responding, χ^2 (4, $\underline{N}$ = 105) = 177.61, $\underline{p}<.001$; and their Block 3 level, χ^2 (4, $\underline{N}$ = 105) = 111.61, $\underline{p}<.001$.

By comparing Tables 3 and 4, one can see that Groups 1, 3 and 4 all had fewer subjects failing to make even one dimensional response on Block 2 length items. This is in contrast to Groups 2 and 5 which actually had an increase in the number of subjects who failed to respond dimensionally on any Block 2 length item. This is further support that Groups 2 and 5 responded comparably on length items.

A comparison of Tables 4 and 5 indicates that for Groups 1, 2, 4 and 5, there was an increase in the

Table 3

Percentage of Length Dimension-naive Subjects in Each Group Making Dimensional Responses on Block 1 Length Items

	Group				
	1	2	3	4	5
Number of Dimensional Responses[a]					
0	37	52	57	69	60
1	32	13	7	19	20
2	21	26	7	8	8
3	11	9	29	4	12
Number of Subjects in Each Group	19	23	14	26	25

$\chi^2(12, \underline{N} = 107) = 15.39, \underline{p} > .22$

[a]By definition, dimension-naive subjects are those with three or fewer dimensional responses to the six length items on Block 1.

Table 4

Percentage of Length Dimension-naive Subjects in Each Group Making Dimensional Responses on Block 2 Length Items

	Group				
	1	2	3	4	5
Number of Dimensional Responses					
0	0	61	7	42	68
1	0	9	0	31	12
2	6	17	0	8	4
3	6	13	0	0	12
4	6	0	0	8	0
5	17	0	21	4	0
6	67	0	71	8	4
Number of Subjects in Each Group	18[a]	23	14	26	25

$\chi^2(24,\ \underline{N} = 106) = 94.63,\ \underline{p} < .001$

[a]Missing data.

Table 5

Percentage of Length Dimension-naive Subjects in Each Group Making Dimensional Responses on Block 3 Length Items

	Group				
	1	2	3	4	5
Number of Dimensional Responses					
0	0	64	7	35	40
1	0	9	0	8	16
2	0	5	0	8	20
3	5	9	0	12	0
4	21	5	7	8	16
5	11	9	14	15	4
6	63	0	71	15	4
Number of Subjects in Each Group	19	22[a]	14	26	25

$\chi^2(24, \underline{N} = 106) = 71.96, \underline{p} < .001$

[a]Missing data.

number of subjects making a majority of dimensional responses to length items between Blocks 2 and 3. The fact that the control group demonstrated such an increase supports the notion that subjects tend to make more dimensional responses with exposure to the task. Figure 1 shows the number of subjects in each group responding dimensionally on a majority of the length items.

Table 6 provides group data for the instructional exercise given between the first and second blocks, and for both the density and length items on the follow-up questionnaire. For subjects who are length dimension-naive, there was no significant difference in the number of subjects responding incorrectly to the exercise questions, χ^2 (3, $\underline{N}$ = 82) = 3.17, $\underline{p}>.36$. Thus, subjects in the four experiemental groups were equally able to classify on the basis of dimensions when instructed to do so.

There was also significant difference in the type of response made by subjects to the first (density) item of the follow-up questionnaire, χ^2 (8, $\underline{N}$ = 106) = 31.67, $\underline{p}<.001$. This confirms that density is indeed the more salient dimension and by the end of the experiement most subjects are using density as a way to classify the stimuli.

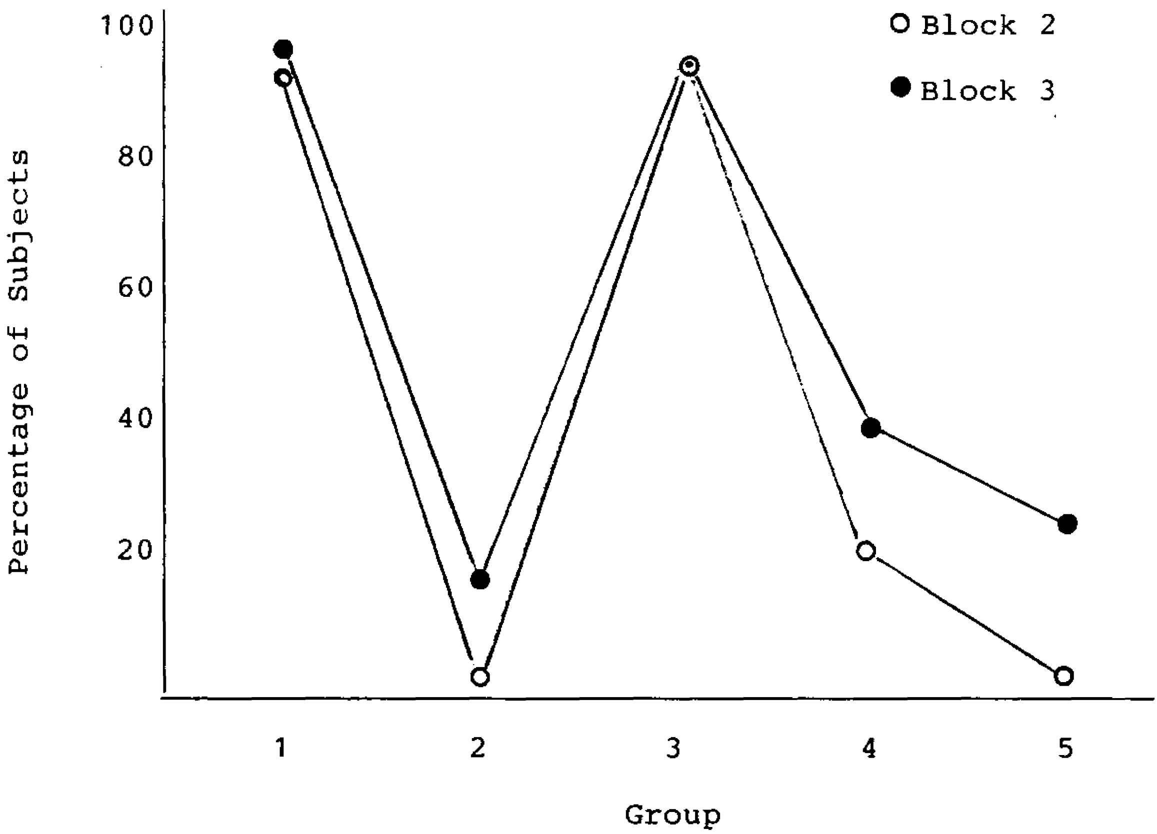


Figure 1. Percentage of length dimension-naive subjects in each group responding dimensionally to a majority of length items on Block 2 and Block 3

Table 6

Percentage of Length Dimension-naive Subjects in Each Group Responding to the Exercise and Follow-up Questionnaire

	Group				
	1	2	3	4	5
Exercise[a]					
Correct	68	70	93	73	N/A[b]
Incorrect[c]	32	30	7	27	N/A[b]
Density Item					
Similarity	16	17	36	23	36
Dimensional	79	83	57	69	64
Haphazard	5	0	7	8	0
Length Item					
Similarity	5	61	7	46	67[d]
Dimensional	95	35	93	54	29[d]
Haphazard	0	4	0	0	4[d]

[a]The exercise/instruction was given between Blocks 1 and 2.

[b]During this time, the control subjects answered neutral demographic questions.

[c]A subject was classified as incorrect when he or she responded inaccurately to one or more of the six exercise questions.

[d]Missing data.

Only subjects given direct or indirect information about the length dimension (i.e., Groups 1, 3, and 4) had a majority of subjects responding dimensionally to the final length item. Length, then, is the more difficult dimension to discover and even after exposure to 18 length items, less than 30% of the control subjects used length as a dimension to classify the stimuli. By comparison, 64% of the control subjects used the density dimension to classify the stimuli on the follow-up density question.

Density Dimension-naive

Table 7 shows the percentage of density dimension-naive subjects making a dimensional response to each of the 18 density items. Here, as in Table 2, the parenthetical block totals represent the mean number of dimensional responses given for the six density items. Groups 1 and 2 demonstrated the greatest increases in dimensional responding on Block 2 relative to their initial levels. The direct instructions were thus effective in producing a strategy shift in the large majority of subjects.

The analogous instruction, however, did not produce an increase in dimensional responding beyond that of the control group. It seems that the greater saliency of the density dimension allowed for a greater

Table 7

Percentage of Dimensional Responses to Density Items Given by Subjects Dimension-naive on Block 1 Density Items

	Group				
	1	2	3	4	5
Item					
2	13	5	8	10	0
4	81	68	69	75	74
7	0	11	0	5	5
9	81	53	15	60	58
10	0	0	8	0	5
12	81	68	69	80	95
	(2.56)	(2.05)	(1.69)	(2.30)	(2.37)
13	63	90	0	50	47
15	69	79	8	40	32
16	69	74	23	25	21
17	94	95	39	70	68
20	100	95	31	75	95
23	81	100	8	85	84
	(4.75)	(5.32)	(1.08)	(3.45)	(3.47)
26	100	90	39	75	95
27	75	68	15	50	42
31	100	95	23	80	95
32	94	90	31	70	74
33	100	79	31	75	90
34	63	74	15	40	21
	(5.31)	(4.95)	(1.54)	(3.90)	(4.16)

spontaneous strategy shift by the control group on density items compared to length items. This greater strategy shift by the control group to density items could thus have masked the moderate effect of the indirect or analogous instructions.

Tables 8, 9 and 10 display the pattern of responses for Blocks 1, 2 and 3 respectively. For these dimension-naive subjects, there was, as expected, no significant difference in the Block 1 levels of dimensional responding, χ^2 (4, N = 89) = 2.73, $p > .60$. There was, however, a significant difference in the level of dimensional response for Block 2, χ^2 (4, N = 89) = 42.14, $p < .001$; and for Block 3, χ^2 (4, N = 89) = 28.14, $p < .001$. Thus, even for density items, there were significant differences among the groups as a result of the instructions.

As Table 9 shows, only Group 3 failed to exhibit a sizable increase in the number of subjects producing a majority of dimensional responses on Block 2. It seems that the length instruction given to these Group 3 subjects interfered with the spontaneous discovery of the density dimension demonstrated by the control group. The increase in dimensional responses across trial blocks demonstrated by Group 5 is evidence that, without hints, subjects slowly learn about the

Table 8

Percentage of Density Dimension-naive Subjects in Each Group Making Dimensional Responses on Block 1 Density Items

	Group				
	1	2	3	4	5
Number of Dimensional Responses[a]					
0	12	15	15	5	0
1	0	20	23	20	21
2	12	5	39	15	21
3	77	60	23	60	58
Number of Subjects in Each Group	17	20	13	20	19

$\chi^2(12, \underline{N} = 89) = 16.77, \underline{p} > .15$

[a]By definition, dimension-naive subjects are those with three or fewer dimensional responses to the six density items in Block 1.

Table 9

Percentage of Density Dimension-naive Subjects in Each Group Making Dimensional Responses on Block 2 Density Items

	Group				
	1	2	3	4	5
Number of Dimensional Responses					
0	0	0	46	15	0
1	6	0	15	10	11
2	6	0	31	5	26
3	6	0	0	15	11
4	24	20	8	15	26
5	29	25	0	20	11
6	29	55	0	20	16
Number of Subjects in Each Group	17	20	13	20	19

$\chi^2(24, \underline{N} = 89) = 58.42, \underline{p} < .001$

Table 10

Percentage of Density Dimension-naive Subjects in Each Group Making Dimensional Responses on Block 3 Density Items

	Group 1	2	3	4	5
Number of Dimensional Responses					
0	6	0	54	10	5
1	0	0	15	10	0
2	0	10	0	5	5
3	0	0	8	10	11
4	29	10	8	20	32
5	6	45	8	10	32
6	59	35	8	35	16
Number of Subjects in Each Group	17	20	13	20	19

$\chi^2(24, \underline{N} = 89) = 58.13, \underline{p} < .001$

dimensional nature of the stimuli and use this information to make perceptual classifications. Figure 2 shows the number of subjects in each group responding dimensionally on a majority of the density items..

As shown in Table 11, for those subjects classified as density dimension-naive, there was no significant difference in the number of subjects making an error on the instructional exercises, χ^2 (3, N = 70) = .70, p>.87. There was also no significant difference in the type of response given to the density item in the follow-up questionnaire, χ^2 (8, 8 = 89) = 13.18, p.10. This again suggests that by the end of the experiement most subjects are using the density dimension to classify the stimuli.

The types of responses given to the follow-up length item, however, were significantly different, χ^2 (8,N=88) = 19.83, p<.05. Table 11 shows that 92% of the length-instructed subjects (Group 3) responded dimensionally to this final length item, whereas only 33% of the control subjects (Group 5) did so. In fact, all groups except the control group had a majority of subjects responding dimensionally to the follow-up length question. Thus, it seems that subjects who are not given a hint as to the dimensional nature of the stimulus, whether that hint is direct or indirect,

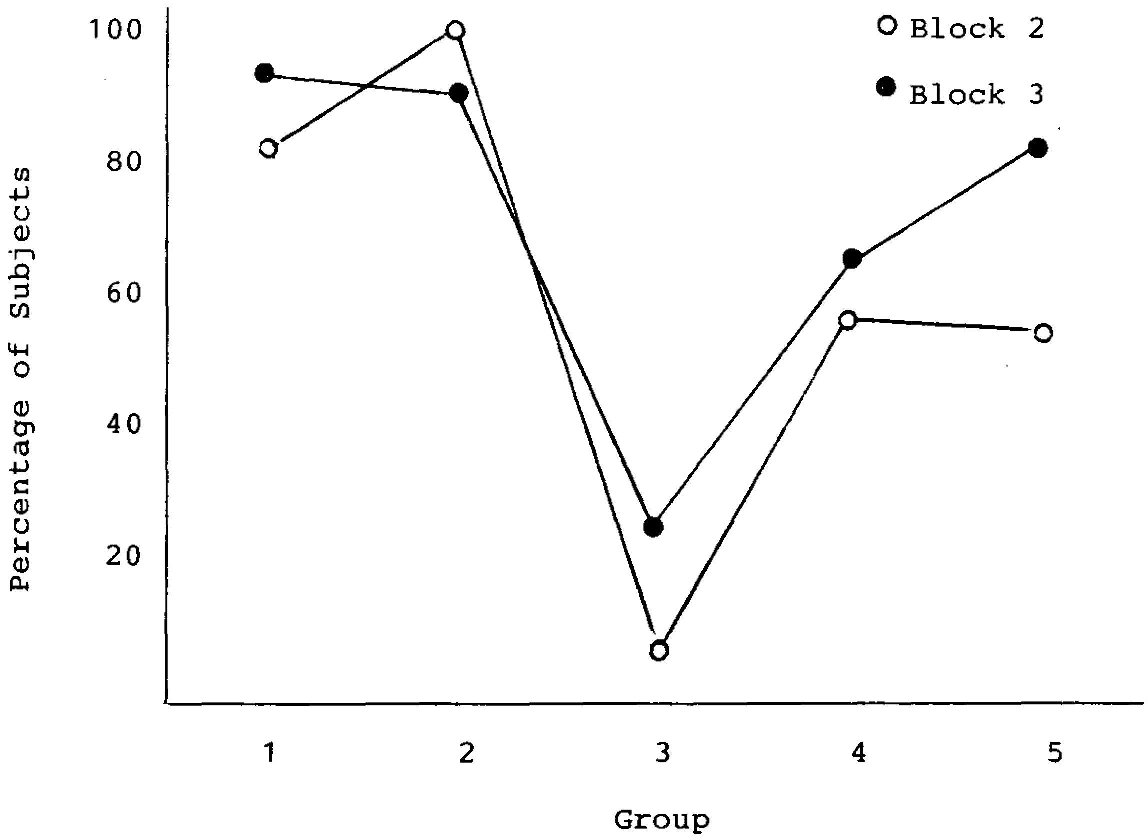


Figure 2. Percentage of density dimension-naive subjects in each group responding dimensionally to a majority of density items on Block 2 and Block 3

Table 11

Percentage of Density Dimension-naive Subjects in Each Group Responding to the Exercise and Follow-up Questionnaire

	Group				
	1	2	3	4	5
Exercise[a]					
Correct	71	70	77	80	N/A[b]
Incorrect	29	30	23	20	N/A[b]
Density Item					
Similarity	18	25	62	25	47
Dimensional	77	75	31	65	53
Haphazard	6	0	8	10	0
Length Item					
Similarity	6	45	8	40	61[d]
Dimensional	88	50	92	60	33[d]
Haphazard	6	5	0	0	6[d]

[a]The exercise/instruction was given between Blocks 1 and 2.

[b]During this time, the control subjects answered neutral demographic questions.

[c]A subjects was classified as incorrect when he or she responded inaccurately to one or more of the six exercise questions.

[d]Missing data.

have a very difficult time discovering length as a relevant dimension. Figures 3 and 4 show the number of subjects responding dimensionally to the follow-up questionnaire's density and length items.

Special Subjects

Six subjects were asked to respond orally to the slide items and to provide a brief reason for their choices. The individual responses of these six verbal report subjects are shown in Table 12.

Subject #153 is typical in terms of the number of dimensional responses given in Block 1. For length items, #153 manufactured two of six possible dimensional responses; for density items, three dimensional responses were given. This can be compared to the overall Block 1 averages of 1.97 on length and 3.26 on density items for the regular subjects.

The first characteristic of the stimuli that this subject mentioned was "the spacing between the dots". Even though the first item is in fact a length item, the subject initially noticed the density aspect of the stimulus, thus producing a similarity response. This supports the claim that density is the more salient dimension. Not surprisingly, the first dimensional response given by this subject occurred on Item 4, a density item.

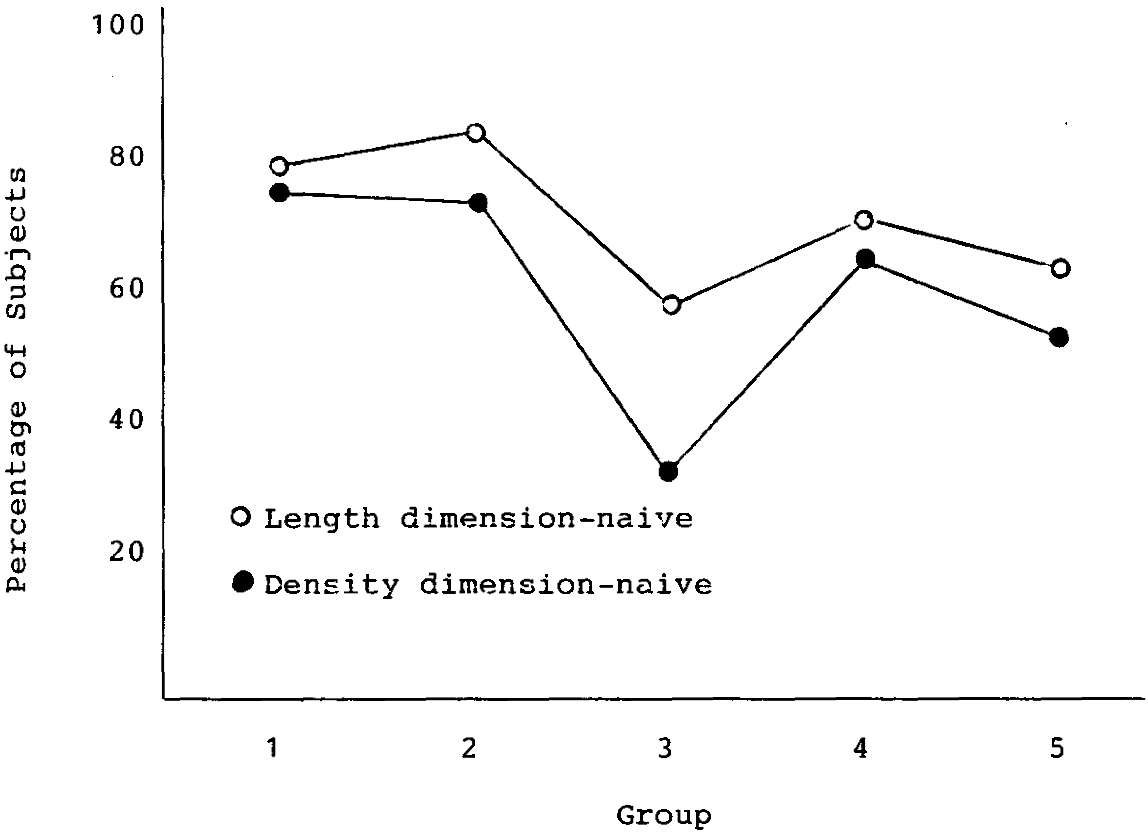


Figure 3. Percentage of dimension-naive subjects in each group responding dimensionally to the follow-up questionnaire's density item

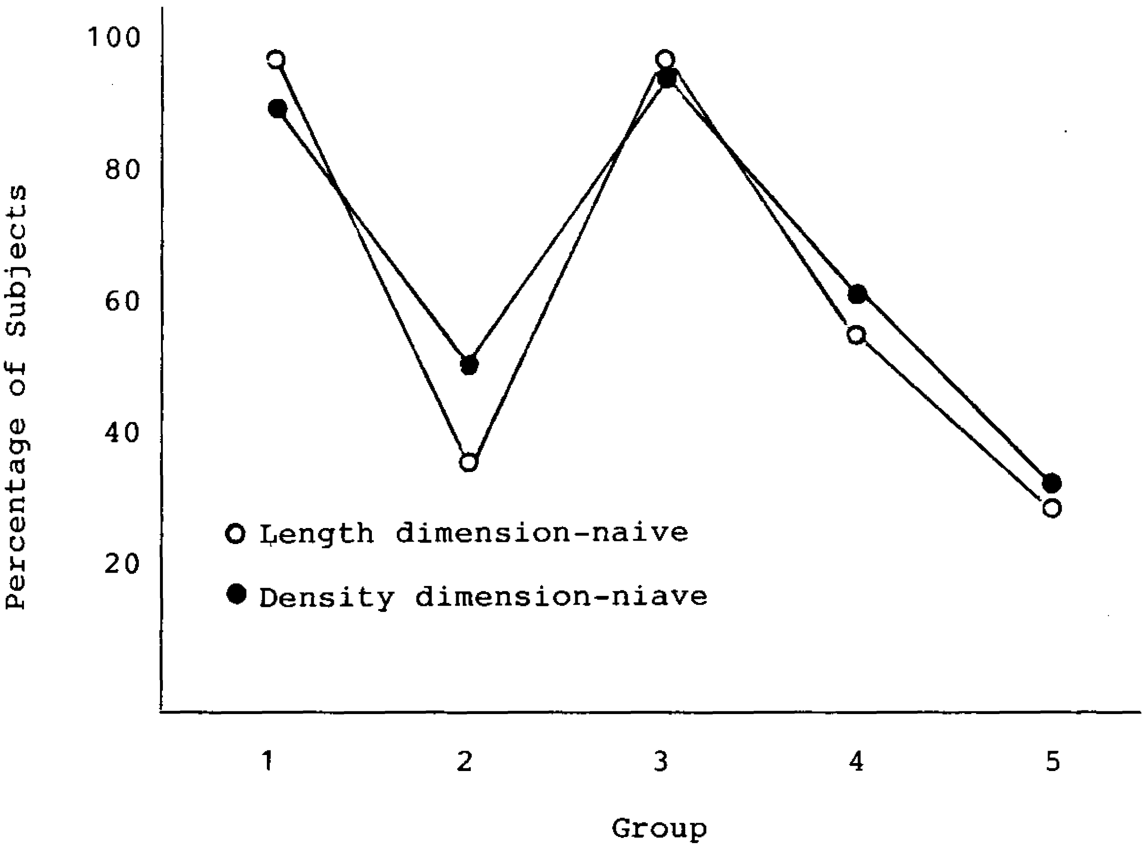


Figure 4. Percentage of dimension-naive subjects in each group responding dimensionally to the follow-up questionnaire's length item

Table 12

Number of Dimensional, Similarity and Haphazard Responses to Length and Density Items for the Six Verbal Report Subjects

Subject Number and Condition	Response Type	LENGTH ITEMS Block 1	2	3	DENSITY ITEMS Block 1	2	3
151	Dimensional	3	5	4	4	6	6
(density	Similarity	3	0	0	2	0	0
hint)	Haphazard	0	1	2	0	0	0
152	Dimensional	4	5	6	6	6	6
(analogous	Similarity	2	1	0	0	0	0
hint)	Haphazard	0	0	0	0	0	0
153	Dimensional	2	6	6	3	5	6
(length &	Similarity	4	0	0	3	1	0
density hint)	Haphazard	0	0	0	0	0	0
154	Dimensional	5	5	6	2	2	2
(two 1-min.	Similarity	0	1	0	3	4	4
breaks)	Haphazard	1	0	0	1	0	0
155	Dimensional	5	6	6	5	5	5
(control	Similarity	1	0	0	1	1	1
questions)	Haphazard	0	0	0	0	0	0
156	Dimensional	1	3	3	0	2	4
(length	Similarity	4	3	3	6	4	3
hint)	Haphazard	1	0	0	0	0	0

Subject #153 received the same length and density training between Blocks 1 and 2 that was given to the regular subjects in Group 1. This subject's only non-dimensional response for the remainder of the experiment came immediately after the training. For this density item, the subject chose the two lines similar in length, noting that they were "about the same length". For the remainder of the experiment, this subject chose the two lines that were exactly the same on some dimension. According to the self-report, Subject #153's initial strategy was to choose the two lines that were "close". After the instructions, however, the subject "made it match".

Subject #151 demonstrated slightly more dimensional responses to density items than to length items, as did the regular subjects as a whole. For Block 1 length items, however, this subject made three dimensional responses followed by three similarity responses. In fact, the verbal report accompanying the first three items makes a reference to the lines being the "same length". Length is only mentioned once more on the next nine items of Block 1, however. Thus, Subject #151 seems to have initially chosen length as the relevant dimension and then, finding it inadequate, switched almost exclusively to the density dimension.

Subject #151, like the regular Group 2 subjects, received density training between Blocks 1 and 2. After this training, the subject never failed to respond dimensionally to density items. For length items, however, this subject did not produce a similarity response for the remainder of the experiement. This is unusual since most subjects trained on density produce more similarity responses to length items. Subject #151 instead demonstrated an increase in the number of haphazard responses made to length items across trial blocks. When a haphazard response was given, the subject stated that the two lines were chosen because "they're extremes". On the follow-up questionnaire, #151 responded dimensionally to the density item and at first, gave a similarity response to the length item. The subject changed to a dimensional response because "it's hard not to look at length".

Subject #156 clearly falls into the dimension-naive category by giving only one dimensional response on Block 1. This subject cited length and density about equally as reasons for choosing the pairs of lines. For the first three items in Block 1, however, density was the reason mentioned. Again, this subject seems to have noticed density before length.

Like the regular subjects in Group 3, #156 was given length instruction. On the first seven items following the training, including both length and density items, this subject made only similarity responses. Then the subject gave only dimensional responses for the next seven items. Subject #156 corrected the response to a Block 2 length item twice to finally arrive at a dimensional response. This subject gave an equal number of dimensional and similarity responses on Block 3 and, in fact, had an equal number of dimensional responses to both length and density items. On the follow-up questionnaire, #156 made a similarity response to boeth the density and length items. This subject's approach, according to the self-report, did not change during the course of the experiment. The subject's response pattern supports this claim since there was never a majority of dimensional responses made in any block for any item type. It seems that the length instruction could not overcome this subject's reliance on overall similarity for making classifications.

Subject #152 was clearly aware of the dimensional nature of the stimuli, at least for the density items, from the beginning of the experiement. This subject gave only three nondimensional responses during the entire experiment, two of which occurred on the first two length items. The verbal reports accompanying these length items mentioned "the space between the dots". Once the length characteristic was noticed, the subject responded dimensionally to all but one of the remaining length items.

Subject #152 gave only one equivocal response, reporting that the two lines were chosen "because of the spacing I guess". The subject responded dimensionally to all 18 density items. Subject #152, like the regular subjects in Group 4, was given information about two analogous dimensions. On the follow-up questionnaire, #156 gave dimensional responses to both length and density items and stated that this approach did not change as the experiement progressed. It seems that once a dimensional strategy is used, subjects do not find it necessary to change strategies.

Subject #155, like Subject #152, seems to be very good at focusing on the dimensional nature of the stimuli, even on Block 1. Only four nondimensional responses were made by this subject, and one was made in response to the first length item. Subject #155 gave a similarity response to this length item, citing density as the reason for the choice ("because the dots are further apart -- closer to the same distance apart"). This subject seemed to have discovered the length dimension on the second length item, and thereafter made dimensional responses to all length items. The remaining three nondimensional responses all involved the same density triad, since the 36 items in the experiment are merely 12 different triads with the placement of each line of the triad varied by block. The subject seems to have made these similarity responses on the basis of the number of dots, rather than on the basis of length or density.

Subject #155 was given only neutral questions, as were the regular subjects in Group 5, during the break between Blocks 1 and 2. This subject responded dimensionally to both items on the follow-up questionnaire and did not report changing strategies during the experiment.

Subject #154, unlike most other subjects, made more dimensional responses to length items than to density items on Block 1. Moreover, #154 did not report using density as a basis for judgment. This subject, however, did cite length of line as a reason for the classification on lines during Block 1.

Unlike any other subject in the experiment, #154 was given two 1-minute breaks between blocks. The number of dimensional responses made by this subject to the density items did not change across blocks, and the rate of dimensional responding to length items remained at a high level. Subject #154 made a similarity response to the density item on the follow-up questionnaire and a dimensional response to the length item. Throughout the experiement this subject seems to have focused on the length and on the number of dots. This subject did not report a change of approach.

DISCUSSION

The results of this experiment can be interpreted according to the categorization system discussed by Foard and Kemler Nelson (1984). These researchers listed stimulus, task and subject factors as the categories of circumstances which promote either integral or separable responding. Each of these three factor types is discussed below.

Stimulus Factors

Garner (1976) stated that multidimensional stimuli exist along a continuum with integrality at one extreme and separability at the other. The stimuli used in the present experiement were lines of dots varying in length and density. According to Ward (1980), length and density are moderately separable and thus allow for greater individual differences. Subjects can use either a holistic or an analytic approach. Previous research (Ward, 1985) has found this choice of approach to be related to the subject's capacity to break stimuli into components. Thus, subjects seem to classify on the basis of their information processing abilities. The instruction to choose the two lines which "go together best" is therefore deliberately ambigous. It allows the subject to choose either an integral or a separable strategy.

The significant main effect of problem type as well as the significant interaction of problem type with hint strength found in the present experiment make it necessary to discuss length and density items as two distinct, nonequivalent entities.

For length items (see Table 2), the analogous hint produced a moderate benefit over the control condition. For density items (see Table 7), the analogous hint was virtually identical to the control condition. Thus, it seems that the same hints can have very different effects on the length and density items. This finding that the analogous instruction was effective for length items but not for density items supports the contention that hints will benefit the less salient dimension of length. The difference in salience is confirmed by the fact that control subjects greatly increased their dimensional responding to density items (see Tables 8, 9 and 10) but not to length items (see Tables 3, 4 and 5).

In addition, instructions to use the opposite dimension (i.e., instructions to use the length dimension on density items and instructions to use the density dimensions on length items) were not equally disruptive to dimensional responding. Providing subjects with information about density did not drastically impair their ability to respond dimensionally on length items relative to the control group. As can be seen in Table 2, subjects in Group 2 did not decrease their dimensional responding across trial blocks. In contrast, subjects told to use the length dimension on density items made significantly fewer dimensional responses than the control group. Thus it seems instructions to use the opposite dimension are much more damaging for density than for length items even though the relative task demands are equivalent. Information about the less salient dimension can disrupt the development of the subject's classification strategy across trial blocks for the more salient dimension.

In general, then, the hypothesis concerning the greater saliency of the density dimension was confirmed. Uninstructed subjects spontaneously increased dimensional responding for density items but not for length items because it is the more difficult dimension to discover spontaneously. In sum, the salience of the stimulus needs to be considered when discussing the effect of instructions upon preceptual classifications.

Task Factors

Task factors, according to Foard and Kemler Nelson (1984), include the effect of an instructional set upon classification style. Weinstein, Underwood, Wicker, and Cubberly (1979) conducted research examining the effectiveness of instructions on cognitive learning strategies. They found that a simple instruction was as beneficial as an elaborate strategy training session when the task to be performed was not particularly difficult.

According to Rigney (1980), instructions and other task factors can be viewed as orienting tasks which cue the subject about how to process the information so that the learning objective can be more quickly realized. Instructions can thus vary in cue strength.

The simple instructions used in the present experiment involve two different kinds of cue strength. One way of discussing their cue strength is in terms of specificity, that is how directly the instructions informed the subjects about the dimensions of length and density. The effect of the more direct instructions (Groups 1, 2 and 3) can thus be contrasted with the effect of an indirect or analogous instruction (Group 4). A second way of describing cue strength is in terms of completeness. The more complete instructions were those which discussed two dimensions (Groups 1 and 4), while the less complete instructions discussed only one dimension (Groups 2 and 3).

The instructions given to Group 1 can be described as both direct and complete. By comparing Tables 2 and 7, it can be seen that the dimension-naive subjects in Group 1 classified separably on 43% of the density items but on only 18% of the length in Block 1. By Block 3, those precentages were 89 and 90 respectively. Hence, even though the more salient dimension of density emerged first, the complete and direct instructions produced superior dimensional responding to both length and density items.

This confirms the hypothesis regarding the length and density instructions. It was predicted that providing subjects with information about both relevant dimensions would produce dimensional responding superior to all other groups. The results indicate that, summed across problem types, the length and density instruction yields a greater incidence of dimensional responding than any other group. When length and density items are considered separately, however, these specific and complete instructions were no better than the specific but incomplete instructions.

Providing subjects with information about both dimensions was equivalent to the less complete (one dimension) instructions for the relevant dimension. In Table 2, for example, the percentage of dimensional responses to length items is virtually identical for Group 1 (length and density instruction) and Group 3 (length-only instruction). Likewise, Table 7 shows that Groups 1 and 2 (density-only instruction) are comparable in their levels of dimensional response to density items. Thus, subjects increase their separable classifications with dimension-relevant instructions, whether those instructions are given alone or included with instructions about other, irrelevant dimensions.

The effect of the complete but indirect (or analogous) instructions (Group 4) seems to vary with problem type. The analogous instructions produced dimensional responding superior to the control group for length items but not for density items. This advantage for length items is also exhibited on the follow-up questionnaire (see Tables 6 and 11). Overall, it seems that if the instructions are explicit, there is no advantage to including an irrelevant dimension for length or for density items. If the instructions are indirect or analogous (i.e., contain two irrelevant dimensions), they tend to help subjects discover only the less salient dimension.

Thus, the hypothesis regarding the continuity of the instructions' effectiveness was only partially supported. It had been predicted that the group receiving the analogous instructions would produce less dimensional responses than the specifically-instructed groups but more dimensional responses than the uninstructed control group. The predicted pattern was evident only for the less salient length items. It may be that the control group's elevated dimensional responding to the more salient density items masked the moderate effect of the analogous instruction. Overall, though, it seems that the degree of strategy shift produced by instructions is positively related to the cue strength of the instructions.

Subject Factors

Ward (1985) found that subjects not only differed in the style of responding with which they approached a classification task, but they also differed in their tendency to adapt that style with exposure to the task. In the present experiment, individual differences in initial processing were so pronounced that some subjects had to be excluded from analysis because their markedly more dimensional style would obscure true differences between the groups due to the instructions.

Examination of the verbal protocol provided by the six special subjects can shed more light on this issue of individual differences. Several researchers, however, have indicated why such verbal reports must be interpreted carefully.

Nisbett and Wilson (1977) caution that even in situations where the subjects seem aware of both the stimulus and their own responses to it, the subject can be unable to correctly report the effect of the stimulus on that response. The cues that a subject uses to make a judgment are not necessarily those which are reported. In addition, subjects are often ignorant of the inaccuracy of their verbal reports. Subjects are more likely to make a correct cause-effect attribution, however, if the report is made soon after the process occurs.

Ericsson and Simon (1980) contend that concurrent probing of a preceptual process may cause subjects to select a more analytic problem solving style. When subjects are asked as they are performing a task about the hypotheses that they are using, the development of those hypotheses can be affected.

More specifically, instructions to verbalize about a visually-presented stimulus may induce subjects to notice critical features (e.g., the dimensionality of the stimulus) that they otherwise might have ignored. Indeed, this may be an effective means of inducing a strategy shift. The verbalization requirement may influence the subject's choice of holistic or analytic mode of processing.

Kail and Bisanz (1982) advise that verbal protocols should be supplemented with other sources of information about the subject's information processing tendencies (e.g., response patterns). The response patterns of the six verbal report subjects can be found in Table 12.

Half of the special subjects can be classified as dimension-naive for each problem type on the basis of their Block 1 response. In addition, the number of dimensional responses given on Block 1 ranged from one to five for length items, and from zero to six for density items. Thus, as with the regular subjects, there are wide individual differences in the strategy with which subjects approached the task.

These individual differences also seem to limit the effect of the instructions. For example, both Subject #153 and Subject #156 were initially dimension-naive on length items and both received instructions to use the length dimension to make classifications.

While both subjects subsequently increased their dimensional responding to length items, Subject #153 classified dimensionally on 100% of the remaining items; Subject #156 on only 50%. Since both subjects demonstrated that they were able to use the length dimension perfectly on the instructional exercises, the difference in their responding must be due to overall differences in the tendency to judge on the basis of similarity.

Thus, as Witkin (1950) has suggested, all subjects may attempt to use an advanced strategy. Some subjects, however, are unable to carry out this strategy because of interference from certain aspects of the stimulus. In the present experiment, subjects who fail to adopt a dimensional stragety for length items even after instruction on the length dimension may have difficulty overcoming their tendency to use the more salient density dimension. As Russo and Dosher (1983) observed, subjects monitor the amount of effort required to perform a strategy. When the effort requirement becomes too great, they abandon the strategy in favor of another, less effortful one.

It should be noted that the comparison of verbal reports and response patterns for these special subjects indicates that they are quite able to report the hypotheses that determine their classifications. They were also accurate in their reporting of how their approach changed during the course of the experiment. For example they could report how the discovery of a particular stimulus dimension caused them to change their mode of processing.

In general, the initial tendency to use a less advanced strategy, for most subjects, can be attributed to a lack of awareness of other strategies. For these subjects, instructions prodcuce a strategy shift toward the more advanced strategy. For a smaller number of subjects, however, the use of the less advanced strategy reflects a deficit in the capacity to successfully utilize the the more advanced strategy. Hence, individual differences on this task seem to include two components: a larger tendency component and a smaller ability component.

Developmental Tendencies

There are several areas of research which suggest that the tendency to shift from integral to separable responding develops with age or experience. Once such area of research involves the effect of impulsivity on perceptual classifications. According to Ward (1963), impulsive adults are more likely to respond integrally, whereas reflective adults tend to make separable responses. The difference lies in the kind rather than in the amount of information used. After a triad is presented, a global or holistic assessment is made and only later are the components analyzed.

According to Monahan and Lockhead (1977), the individual differences exhibited by subjects in the classification task may reflect either the speed of response or the time required to shift between processing modes. Subjects may respond integrally because they make a hasty response or because they require more time to shift from holistic to analytic processing for each item. Thus, a similarity response may indicate either impulsivity or a greater amount of time devoted to holistic processing. The results of this experiment seem to favor impulisivity. When subjects were forced to elaborate on their responses within the verbal report paradigm, they produced proportionately more dimensional responses than did the regular subjects as a whole.

Smith and Kemler Nelson (1984) believe the tendency of children to be generally impulsive in cognitive tasks underlies their more integral style of classification. While adults tend to make more separable responses, they do not rigidly adhere to that approach. Thus, adults are more flexible in their use of overall similarity, while children can make a dimensional response only with great effort. Ward (1980) found that in restricted classification of length and density items, children, unlike adults, did not change their pattern of responding even though they seemed to be aware of the dimensional nature of the stimulus.

Other evidence that the integral approach develops can be found in the response patterns of learning disabled children. Ward (1986) found that nondisabled children tend to produce more dimensional responses as they get older. Learning disabled children, however, do not change their level of similarity classification with age, especially on the dimensions of length and density. This supports Smith and Kemler Nelsoon's (1984) contention that developmentally disadvantaged individuals rely on a primary and primitive similarity classification mode with only effortful access to a dimensional mode. Thus, the dimensional responding of the subjects in the present experiment can be viewed as existing along a continuum of effort. For some subjects, a dimensional response is made with ease; for others it requires much more effort. This may reflect individual differences in perceptual maturity.

General Findings

The results of this experiment indicate that instructions can mitigate these differences in strategy preference. While it was shown that there were very large differences in the subjects' initial mode of processing, the effect of the instructions was to make the dimensional mode more apparent and accessible for most subjects.

It should be noted, however, that even the most direct and complete instructions did not make all subjects classify in a perfectly dimensional manner. This is evidence that the restricted classification of length and density items is not a task which merely measures the ability of the subject to notice the dimensionality of the stimulus. Rather, the classification task is a measure of a much more generalized tendency to process perceptual stimuli on the basis of overall similarity or specific dimensions.

Ward (1985), for example, found that the propensity to shift toward more dimensional responses is associated with other, more generalized spatial abilities, such as the ability to break perceptual stimuli into components. Spiro and Tirre (1980) suggest that differences in spatial information processing may also relate to verbal information processing abilities.

The change of approach demonstrated by subjects receiving the direct instructions is applicable to engineering, architecture and other fields where a more analytic approach to spatial problems is advantageous. The ability of individuals to shift to a more dimensional style of responding after simple direct instructions may be associated with greater disembedding ability and other perceptual abilities relevant in this domain. Simple instructions may also help individuals focus on the critical aspects of particular problems and thus provide an easily administered shortcut to the analysis of relevant dimensions.

The effect of the analogous instruction is more intriguing. While the effect was qualified by the saliency of the dimension, it does suggest that information about analogous dimensions can aid in the analysis of a different problem. Thus, providing individuals with information about how an unrelated problem was analyzed or solved can help in the solution of their current problem.

Overall, the results of the present experiment support Smith and Baron's (1981) contention that responses on the restricted classification task reflect the subject's tendency to process information in a particular way. The effect of the instructions was to make most subjects process the information contained in the stimuli more analytically. Individual differences, however, must be considered. Some subjects maintained an integral style of responding despite explicit instructions to analyze the stimuli into component dimensions. This suggest that Ward (1985) may be correct in his suggestion that some subjects are less able to break down the stimuli into dimensions. Thus, unless subjects are extremely impulsive or bound by the overall similarity of the stimulus, simple instructions are an effective means of producing a strategy shift toward more dimensional responding.

Much work needs to be done in determining how stimulus saliencies, individual differences and instructions affect the nature of our perceptual processing. This experiment identified subject, stimulus and task factors. Specifically, there were consistent individual differences in the classification strategies with which people approached a perceptual task. Differences were also found in the type of processing performed on length and density items. Instructions to use a dimensional approach differentially affected these two types of items. Overall, subjects refine their classification strategy to become more dimensional with exposure to the task, and the stronger and more relevant the instructions with which they are provided, the more easily that refinement occurs.

REFERENCES

Ashby, F. G., & Townsend, J. T. (1986). Varities of perceptual independence. Psychological Review, 93, 154-179.

Barratt, E. S. (1953). An analysis of verbal reports of solving spatial problems as an aid in identifying spatial factors. The Journal of Psychology, 36, 17-25.

Battig, W. F. (1979). Are the important 'individual differences' between or within individuals? Journal of Research in Personality, 13, 546-558.

Cooper, L. A. (1976). Individual differences in visual comparison processes. Perception & Psychophysics, 19, 433-444.

Cooper, L. A. (1980). Spatial information processing: Strategies for research. In R. E. Snow, P. Federico, W. E. Montague (Eds.), Aptitude, learning, and instruction (pp. 149-176). Hillsdale, NJ: Erlbaum.

Ericsson, K. A., & Simon, H. A. (1980). Verbal reports as data. Psychological Review, 87, 215-251.

Foard, C. F., & Kemler Nelson, D. G. (1984). Holistic and analytic modes of processing: The multiple determinants of perceptual analysis. Journal of Experimental Psychology: General, 113, 94-111.

Garner, W. R. (1969). Speed of discrimination with redundant stimulus attributes. Perception & Psychophysics, 6, 221-224.

Garner, W. R. (1970). The stimulus in information processing. American Psychologist, 25, 350-358.

Garner, W. R. (1974). The processing of information and structure. New York: John Wiley.

Garner, W. R. (1976). Interaction of stimulus dimensions in concept and choice processes. Cognitive Psychology, 8, 98-123.

Garner, W. R., & Felfoldy, G. L. (1970). Integrality of stimulus dimensions in various types of information processing. Cognitive Psychology, 1, 225-241.

Garner, W. R., & Flowers, J. H. (1969). The effect of redundant stimulus elements on visual discrimination as a function of element heterogeneity, equal discriminability, and position uncertainty. Perception & Psychophysics, 6, 216-220.

Hock, H. S., Gordon, G. P., & Marcus, N. (1974). Individual differences in the detection of embedded figures. Perception & Psychophysics, 15, 47-52.

Kail, R. V., Jr., & Bisanz, J. (1982). Cognitive strategies. In C. R. Puff (Ed.), Handbook of research methods in memory and cognition (pp. 229-255). New York: Academic Press.

Lockhead, G. R. (1966). Effects of dimensional redundancy on visual discrimination. Journal of Experimental Psychology, 72, 95-104.

MacLeod, C. M., Hunt, E. B., & Mathews, N. N. (1978). Individual differences in the verification of sentence-picture relationships. Journal of Verbal Learning and Verbal Behavior, 17, 493-507.

Marton, F., & Saljo, R. (1976). On qualitative differences in learning: Outcome as a function of the learner's conception of the task. British Journal of Educational Psychology, 46, 115-127.

McDaniel, M. A., & Kearney, E. M. (1984). Optimal learning strategies and their spontaneous use: The importance of task-appropriate processing. Memory & Cognition, 12, 361-373.

Monahan, J. S., & Lockhead, G. R. (1977). Identification of integral stimuli. Journal of Experimental Psychology, 106, 94-110.

Nisbett, R. E., & wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. Psychological Review, 84, 231-259.

Rigney, J. W. (1978). Learning strategies: A theoretical perspective. In H. F. O'Neil, Jr. (Ed.), Learning strategies (pp. 165-205). New York: Academic Press.

Rigney, J. W. (1980). Cognitive learning strategies and dualities in information processing. In R. E. Snow, P. Federico, & W. E. Montague (Eds.), Aptitude, learning, and instruction (pp. 315-343). Hillsdale, NJ: Erlbaum.

Russo, J. E., & Dosher, B. A. (1983). Strategies for multiattribute binary choice. Journal of Experimental Psychology: Learning, Memory, and Cognition, 9, 676-696.

Simon, H. A., & Reed, S. K. (1976). Modelling strategy shifts in a problem-solving task. Cognitive Psychology, 8, 86-97.

Smith, J. D., & Baron, J. (1981). Individual differences in the classification of stimuli by dimensions. Journal of Experimental Psychology: Human Perception and Performance, 7, 1132-1145.

Smith, J. D., & Kemler Nelson, D. G. (1984). Overall similarity in adults' classification: The child in all of us. Journal of Experimental Psychology: General, 113, 137-159.

Spiro, R. J., & Tirre, W. C. (1980). Individual differences in schema utilization during discourse processing. Journal of Educational Psychology, 72, 204-208.

Sternberg, R. J. (1984). Mechanisms of cognitive growth: A componential approach. In R. J. Sternberg (Ed.), Mechanisms of cognitive development (pp. 164-186).

New York: Freeman.

Ward, T. B. (1980). Separable and integral responding by children and adults to the dimensions of length and density. Child Development, 51, 676-684.

Ward, T. B. (1983). Response tempo and separable-integral responding: Evidence for an integral-to-separable processing sequence in visual perception. Journal of Experimental Psychology: Human Perception and Performance, 9, 103-112.

Ward, T. B. (1985). Individual differences in processing stimulus dimensions: Relation to selective processing mechanisms. Perception & Psychophysics, 37, 471-482.

Ward, T. B. (1986). Classifying by learning disabled and nondisabled children: Use of overall similarity versus dimensional relations. Bulletin of the Psychonomic Society, 24, 131-134.

Ward, T. B., & Lewis, S. N. (1987). The influence of alcohol and loud music on analytic and holistic processing. Perception & Psychophysics, 41, 179-186.

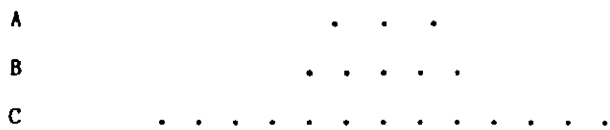
Weinstein, C. E., Underwood, V. L., Wicker, F. W., & Cubberly, W. E. (1979). Cognitive learning strategies: Verbal and imaginal elaboration. In H. F. O'Neil, Jr., & C. D. Spielberger (Eds.), Cognitive and affective learning strategies (pp. 45-75). New York: Academic Press.

Witkin, H. A. (1950). Individual differences in ease of perception of embedded figures. Journal of Personality, 19, 1-15.

Witkin, H. A. (1978). Cognitive styles in personal and cultural adaptation. Worcester, MA: Clark University Press.

Witkin, H. A., & Goodenough, D. R. (1981). Cognitive styles: Essence and origins. New York: International Universities Press.

APPENDIX A

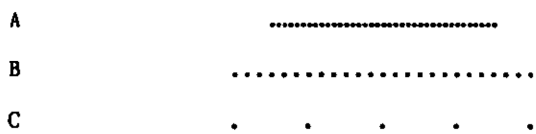


Example of a Density Triad

A & B = similarity pair / integral response

B & C = dimensional pair / separable response

A & C = anomalous pair / haphazard response



Example of a Length Triad

A & B = similarity pair / integral response

B & C = dimensional pair / separable response

A & C = anomalous pair / haphazard response

APPENDIX B

As you may have noticed, the items can be grouped on the basis of their spacing.

For example, for these items:

A . . .

B . . . . .

C . . . .

B & C have the same spacing.

For the following items, please indicate the pair which have the same spacing.

A ....

B ....

C ....

___ & ___ have the same spacing.

A . .

B . .

C . . . .

___ & ___ have the same spacing.

A ....

B ....

C ....

___ & ___ have the same spacing.

Please turn to the next page.

In addition to being grouped on the basis of their spacing, these items can also be grouped on the basis of their length. For example, for these items:

A ....

B ....

C . . . . .

B & C are the same length.

For the following items, please indicate the pair which are the same in length.

A . . . .

B . . . .

C ....

___ & ___ are the same length.

A . . . .

B . . . .

C . . . .

___ & ___ are the same length.

A ....

B . . . .

C . . . .

___ & ___ are the same length.

**NOTE: Please use these methods of grouping the items as the rest of the slides are presented.

PLEASE TURN BACK TO PAGE 1

As you may have noticed, the items can be grouped on the basis of their spacing.

For example, for these items:

A . . .

B . . . . .

C . . . .

_B_ & _C_ have the same spacing.

For the following items, please indicate the pair which have the same spacing.

A ....

B ....

C ....

___ & ___ have the same spacing.

A . . . .

B . . . .

C . . . . .

___ & ___ have the same spacing.

A . .

B . .

C . . . .

___ & ___ have the same spacing.

Please turn to the next page.

Please continue to indicate the pair which have the same spacing.

A . . . .

B . . . . .

C . .

___ & ___ have the same spacing.

A ....

B ....

C ....

___ & ___ have the same spacing.

A . . . .

B . . .

C . . . .

___ & ___ have the same spacing.

**NOTE: Please use this method of grouping the items as the rest of the slides are presented.

PLEASE TURN BACK TO PAGE 1

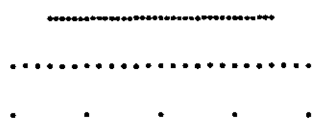
As you may have noticed, the items can be grouped on the basis of their length.

For example, for these items:

A

B

C



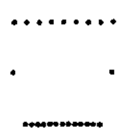
_B_ & _C_ have the same length.

For the following items, please indicate the pair which have the same length.

A

B

C

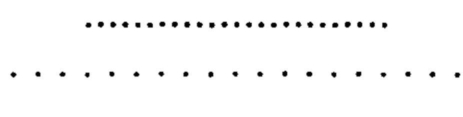


___ & ___ have the same length.

A

B

C

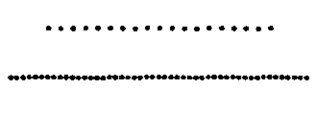


___ & ___ have the same length.

A

B

C



___ & ___ have the same length.

Please turn to the next page.

Please continue to indicate the pair which have the same length.

A . . . .

B . . . .

C . . . .

___ & ___ have the same length.

A . .

B . .

C ....

___ & ___ have the same length.

A . . . .

B ....

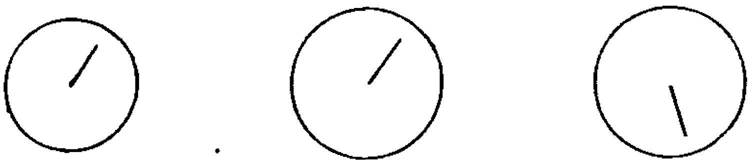
C . . . .

___ & ___ have the same length.

**NOTE: Please use this method of grouping the items as the rest of the slides are presented.

PLEASE TURN BACK TO PAGE 1

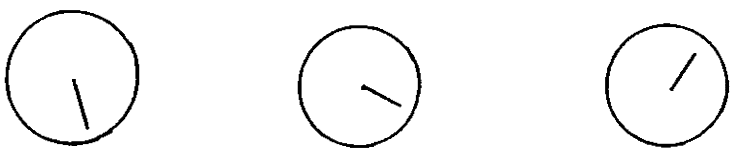
The items below, like the items presented on the slides, can be grouped on the basis of two different characteristics. The figures below can be grouped on the basis of circle size. For example, for these items:



A B C

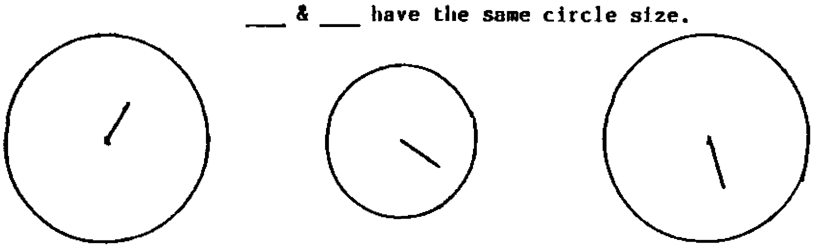
B & C have the same circle size.

For the following items, please indicate the pair which have the same circle size.



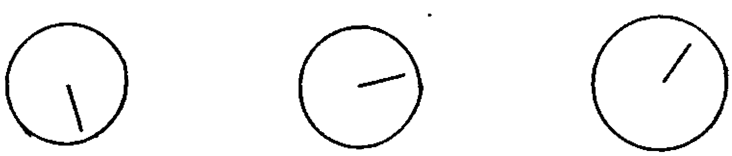
A B C

___ & ___ have the same circle size.



A B C

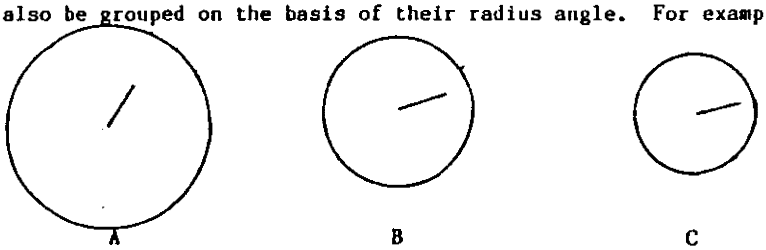
___ & ___ have the same circle size.



A B C

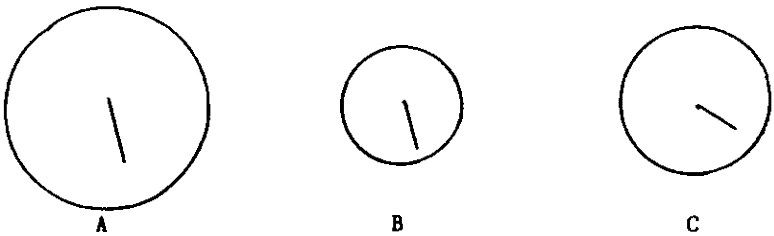
___ & ___ have the same circle size. Please turn the page.

In addition to being grouped on the basis of their circle size, these figures can also be grouped on the basis of their radius angle. For example, these items:

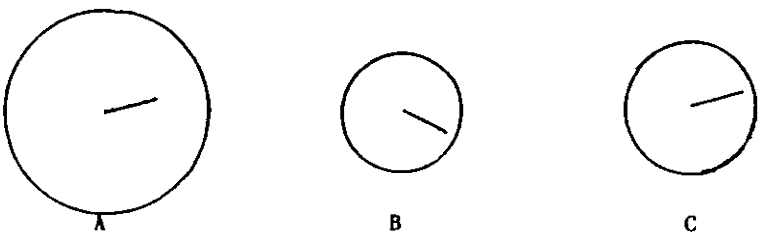


B & C have the same radius angle.

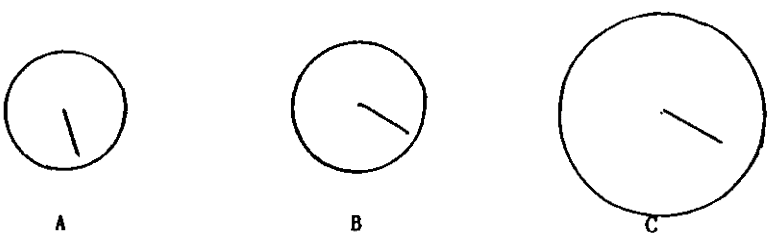
For the following items, please indicate the pair which have the same radius angle.



___ & ___ have the same radius angle.



___ & ___ have the same radius angle.



___ & ___ have the same radius angle.

**NOTE: Please use similar methods of grouping the characteristics of the items as the rest of the slides are presented.

PLEASE TURN BACK TO PAGE 1

Please provide the following information that applies to you:

Please mark an "X" by the appropriate line.

Sex:

___ Female

___ Male

Year in School:

___ Freshmen

___ Sophomore

___ Junior

___ Senior

___ Graduate Student

Hours Taken Last Semester:

___ 1-8

___ 9-14

___ 15-18

___ More than 18

Please turn to the next page.

Please continue to mark an "X" on the appropriate lines.

Employment:

___ Do not work outside of school.

___ 1-9 hours per week.

___ 10-19 hours per week.

___ 20-32 hours per week.

___ 33-39 hours per week.

___ 40 or more hours per week.

College Major:

___ Accounting

___ Biology

___ Chemistry

___ Communication

___ Criminal Justice

___ Economics

___ English

___ History

___ Marketing

___ Mathematical Sciences

___ Physics

___ Psychology

___ Social Work

___ Other

Marital Status:

___ Single ___ Married

PLEASE TURN BACK TO PAGE 1

APPENDIX C

SUBJECT # ________________ DATE ________________

DO NOT TURN PAGE UNTIL INSTRUCTED TO DO SO.

For items 1 through 36, please write down the letters of the two lines which go together best.

1. ____ & ____
2. ____ & ____
3. ____ & ____
4. ____ & ____
5. ____ & ____
6. ____ & ____
7. ____ & ____
8. ____ & ____
9. ____ & ____
10. ____ & ____
11. ____ & ____
12. ____ & ____

When instructed to do so, please turn to page 2 and answer the questions on pages 2 and 3 ONLY.

13. ____ & ____
14. ____ & ____
15. ____ & ____
16. ____ & ____
17. ____ & ____
18. ____ & ____
19. ____ & ____
20. ____ & ____
21. ____ & ____
22. ____ & ____
23. ____ & ____
24. ____ & ____

Please wait for further instructions.

25. ____ & ____
26. ____ & ____
27. ____ & ____
28. ____ & ____
29. ____ & ____
30. ____ & ____
31. ____ & ____
32. ____ & ____
33. ____ & ____
34. ____ & ____
35. ____ & ____
36. ____ & ____

When instructed to do so, please turn to page 4 and answer the questions on pages 4 and 5.

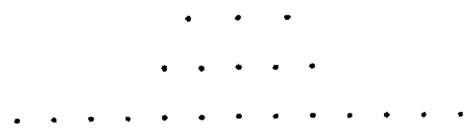
Please answer the following questions as completely as possible in the blanks provided. (Additional comments can be made on the back of this form.)

Example 1:

A

B

C



1. For Example 1, which two lines do you think go together best? _____ & _____
2. Why? ______________________________
3. How are lines A and B alike? ______________________________
4. How do A & B differ? ______________________________
5. How are lines B and C alike? ______________________________
6. How do B & C differ? ______________________________
7. How are lines A and C alike? ______________________________
8. How do A & C differ? ______________________________
9. In this instance, how do you define "go together best"? ______________________________

____

10. Did your definition of "go together best" change during the course of the experiment? _________ If so, how? ______________________________

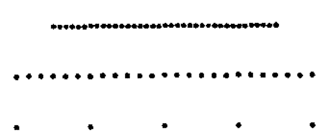
____

Example 2:

A

B

C



11. For Example 2, which two lines do you think go together best? _____ & _____
12. Why? ______________________________

(TURN TO NEXT PAGE)

13. How are lines A and B alike? ______________________________

14. How do lines A & B differ? ______________________________

15. How are lines B and C alike? ______________________________

16. How do lines B & C differ? ______________________________

17. How are lines A and C alike? ______________________________

18. How do lines A & C differ? ______________________________

19. In this instance, how do you define "go together best"? ____________

____

20. For both Examples 1 and 2, what does "go together best" mean? ________

____

APPROVAL SHEET

The dissertation submitted by Cathleen Campbell-Raufer has been read and approved by the following committee:

Fr. Daniel O'Connell, S.J., Director
Professor, Psychology, Loyola

Dr. Jill Reich
Professor, Psychology and
Associate Dean, Graduate School, Loyola

Dr. Eugene B. Zechmeister
Professor, Psychology, Loyola

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December 8/1987 — Daniel C. O'Connell S.J.

Date — Director's Signature