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AUTHOR	Parsons, Ronald J.
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ABSTRACT

The problem investigated was the relationship between cognitive category width and certain other cognitive and perceptual variables, with the intent of gaining additional insight into the effect which individual differences in cognitive conceptualization exert on certain other behaviors. Cognitive category width, defined as the score obtained on the Pettigrew Category Width Scale, was found to be functionally related to certain types of mental tasks, but not to others. Stimulus generalization, either perceptually or through verbal mediation, was not found significantly related to width of categorization. A second study found broad categorizers to be somewhat more field independent in a Rod and Frame Test. There was, however, a significant interaction between sex and category width, with males who were broad categorizers superior to those who were narrow categorizers, the reverse being true for females. The third area of investigation found highly significant differences between broad and narrow categorizers in the learning of multiattribute paired associates. Conclusions suggest that performance in a simple perception task does not appear to be a significant function of category width per se. Generalizations regarding relationships between category width and field dependence remain inconclusive. (Author/CJ)

FINAL REPORT

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Ronald J. Parsons
Missouri Valley College
Marshall, Mo. 65340

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C O N T E N T S

SUMMARY

The problem investigated in this study was the relationship between cognitive category width and certain other cognitive and perceptual variables. The concept of category-width--the amount of divergence which individuals are willing to subsume under a single classification, or the extremes of inclusiveness which one employs for a concept--provides a potentially meaningful base for launching an investigation of individual differences in certain learning and perceptual processes. Category width, as used within this study, was operationally defined as the score obtained by means of an instrument known as the Pettigrew Category-Width Scale.

The research focused on three central issues. The issues, and the hypothesis tested for each, were as follows:

1. Stimulus generalization as a function of category width. It was hypothesized that broad categorizers would manifest a greater degree of generalization to a given stimulus than would narrow categorizers. Two types of stimulus generalization were explored--simple perceptual generalization of a visual stimulus, and mediated generalization in a verbal learning task. Neither type of generalization provided support for the hypothesis.

2. Category width and field dependence. The hypothesis which was formulated predicted that broad categorizers would show a lesser degree of field dependence than would narrow categorizers. The test of field dependence was the S's performance on the Rod-and-Frame test. Comparison of the error scores of ten extremely broad categorizers with ten extremely narrow categorizers produced superior performance by the broad categorizers, as seen in a smaller mean error. There was, however an interaction of sex and category width. Males who were broad categorizers were superior to the male narrow categorizers. The reverse, however, was seen in the female Ss, with narrow categorizers having smaller error scores.

3. Category width and the learning of multi-attribute paired associates. The hypothesis that recall of attributes in a multi-attribute learning task would be functionally related to cognitive category width was evaluated in a design utilizing paired-associate learning. Using 12 extremely broad and 12 extremely narrow categorizers, as measured by the Pettigrew Category Width Scale, subjects were tested for recall of the stimulus attributes, after having learned seven S-R pairs to criterion. The broad categorizers were able to recall double the number of stimulus attributes recalled by narrow categorizers, providing strong support for the hypothesis. These data suggest the possibility that individual differences in cognitive categorization may be consistently reflected in the person's preferred manner of orienting himself to, and processing, the stimuli presented by his world.

INTRODUCTION

Background for the Study

The view that significant individual differences exist in a variety of cognitive functions related to perceptual and judgmental processes has attained a degree of prominence in recent research literature. It appears that a distinct form of "cognitive orientation" influences the way in which a person organizes and processes the information available to him. Individuals show characteristic tendencies to utilize "broad" or "narrow" categories in judgments of similarities or equivalence. Much of the research interest has been generated by the development of an instrument for the measurement of cognitive category width by Pettigrew (1958). (A sample of questions included in the Pettigrew Category-Width Scale is contained in Appendix A.)

Two modes of cognitive activity are seen by Pettigrew as being related to category width. One is "equivalence range" or the number of objects or events one is willing to subsume under a given category. The second is "risk taking" in which narrow categorizers are viewed as conceptually more "conservative" than broad categorizers.

The category width variable has been related to other variables in a number of studies. Pettigrew (1958) pointed to a sex-related variable, finding females to be consistently narrower in their judgments than males. Under the conditions of uncertainty of this scale, in which the estimations (e.g. the length of whales in the North Atlantic) are almost invariably made in the absence of any prior experience or knowledge of the range of measures, females tend to categorize more conservatively, i.e. to make their estimates closer to the stated mean. Other researchers, such as Wallach and Kogan (1959), have shown females to be <u>less</u> conservative in situations which provide the possibility of greater subjective certainty in the judgments, such as risks in marriage choices.

Additional investigations have attempted to assess functional relationships between category width and perceptual judgments. Messick and Damarin (1964) found narrow categorizers to be superior in a memory for faces study, and suggest that narrow category width may facilitate recall of other spacial patterns as well. Bruner and Tajfel (1961), in demonstrating that narrow categorizers had

greater sensitivity to changes in the environment, utilized a design which systematically varied the number of tachistoscopically presented dots which Ss judged in relation to a given quantitative standard. Taylor and Levitt (1967) found that broad categorizers prefer a greater variety of environmental stimuli than do narrow categorizers.

In certain respects the theoretical model most suggestive for this research has been the information processing model. If the broad categorizer functions cognitively in a manner which differs from that of a narrow categorizer, then the selection input data, the storing, processing and retrieval of this information by the CNS may be seen as, in part, a function of his category width. If, indeed, broad categorizers orient themselves to their world in a less restricted manner, it may be hypothesized that they will be attuned to a greater diversity of perceptual stimuli impinging on their receptors.

Problems Under Consideration

The research summarized in this report was devoted to the investigation of several variables which were regarded as potentially related to the concept of category width. The possible relationship to individual differences in certain aspects of the learning process were of particular concern. As Bruner, et al state in A Study of Thinking, "The learning and utilization of categories represents one of the most elementary and general forms of cognition by which a man adjusts to his environment."

Three basic problems were investigated, each related to the category width variable. The problems studied are as follows:

1. The relationship between cognitive categorization and stimulus generalization.

The acquisition of learned response patterns and the differentiation of the stimuli to which a response occurs is a central issue in human learning. The specific problem investigated was: Can individual differences in perceptual and mediated stimulus generalization be demonstrated to be a function of variability in category width.

2. Category width and field dependence.

Research initiated many years ago has demonstrated consistently that females tend to be more "field dependent" than males, as measured by such behaviors as performance in the Rod-and Frame Test. In this test the subject attempts to adjust a luminous rod to a vertical position within a luminous frame tilted away from the vertical. The subject is seated in a darkened room in a chair which may also be tilted away from the upright position.

The problem investigated was to determine if a functional relationship exists between category width and field dependence; i.e. will a female who is a broad categorizer on the Pettigrew scale

(thus functioning in a "masculine" manner) also perform more like the males on the Rod-and-Frame T[illegible], showing greater independence from the influence of the restri[illegible] visual field.

3. Category Width and the L[illegible]ning of Multi-Attribute Paired-Associates.

The basic que[illegible]on investigat[illegible] this study was to determine if extremely broad [illegible] extremely na[illegible] categorizers functioned differentially in the "processing" of information in a learning task. The design incorporated materials in which the learning could occur using either few or many attributes present in the stimulus field.

In this report the three investigations are presented separately, with the hypothesis, method, results and discussion for each problem contained as a single unit.

I. STIMULUS GENERALIZATION AS A FUNCTION OF C-W

Two stimulus generalization designs were utilized. The first investigated simple generalization of responses to a visual stimulus. The second looked at generalization as it occurred in verbal mediation. The first will be reported only briefly, since it was largely a pre-test; the second will be described in greater detail.

In the first design, using subjects drawn from 250 Missouri Valley College students to whom had been administered the Pettigrew Category Width Scale, the relationship between category width and perceptual stimulus generalization was studied.

Twenty-four Ss were used, twelve extremely broad categorizers and twelve extremely narrow categorizers, with an equal number of males and females in each group. Ss were selected from the extreme scores of the above-mentioned 250 students.

A design similar to that used by Brown, et al (1951) to measure bidirectional gradients in the generalization of visual-spatial stimuli was used. Ss were instructed to react only to the center light of a series of seven lights mounted on a panel in front of them. It was hypothesized that broad categorizers would react to a greater number of lights other than the center one than would narrow categorizers, thus indicating greater stimulus generalization.

The hypothesis was not supported. Differences, while in the direction hypothesized, were not statistically significant.

Lack of support for the hypothesis was not surprising, in view of the fact that the task was largely a physiological one, presenting minimal opportunity for variations in cognitive [illegible]ceptualizing to occur. The second stimulus generalization expe[illegible]nt was, however,

seen as providing such opportunity for greater cognitive variation. A description of this study of mediated generalization as a function of category width follows.

Foley and Cofer (1943) reported that recall of a test list was significantly improved by learning of a synonymous or homonymous training list prior to recall as compared to recall after practice on an unrelated list. The experimenters hypothesized that this increased performance was due to tacit rehearsal of synonyms or homonyms as the training list was presented which strengthened the response tendencies for the related words in a test list. The improved recall of related lists is hypothesized to be due to tacit practice on the test list through neural generalization of neural processes stimulated by the training list rehearsal. Pettigrew's concept of Category Width includes a stimulus equivalence component and a risk-taking element. Broad categorizers tend to have wider stimulus equivalence ranges with more inclusive response categories than narrow categorizers. While experiments have supported this idea for purely perceptual stimuli, this experiment was aimed at examining the cognitive effect of Category Width on Mediated Generalization. If the broad categorizer has wider cognitive equivalence ranges than the narrow categorizer, neural excitation causing mediated generalization should be more widespread anatomically in broad categorizers and should increase the probability of arousal of neural traces holding the words on the related test list and increase their response tendencies. This increased probability of rehearsal should be reflected by superior recall by broad categorizers of synonyms or homonyms trial lists, which is the hypothesis tested in this experiment.

METHOD

Materials.--Apparatus used consisted of a Lafayette memory drum and word lists, pencil, and 3" X 5" unlined answer sheet. Each S was presented with three pairs of lists, one pair being unrelated to serve as a control for baseline performance, one pair containing synonyms in each list, and one pair being homonyms (see Table 1 for elements in these lists).

Procedure--115 students in introductory psychology laboratories at the University of Missouri were administered the Estimation Questionnaire (Category Width Scale). The 10 high and 10 low Category Width scores for both male and female students were tested on the Mediated Generalization task without their awareness of the connection of the two tasks. Subjects were contacted by telephone and scheduled in advance so that the E was unaware of the Category Width score of the S. The S was introduced into the experimental room and seated in a chair facing the memory drum which was placed on a table chest high in front of the S. The procedure was explained to the S and any questions answered. The E then read the following printed instructions to the S as the S read along silently:

Table 1

Control*		Synonym**		Homonym**	
Train	Test	Train	Test	Train	Test
[illegible]	palm	error	mi[illegible]	four	for
form	set	joyful	ju[illegible]	pane	pain
pear	reed	package	parcel	vane	vain
dough	very	incline	grade	write	right
reign	numb	detest	loathe	rain	reign
rent	me	swamp	bog	due	do
meet	day	enigma	problem	pen	pin
sees	snap	chide	scold	rode	road
knows	rope	filthy	nasty	sow	sew
right	spare	lift	hoist	weak	week

"Watch the aperture in which a series of words are to be exposed one at a time. As each word is exposed, say it aloud and think of its meanings. The first list will be presented four (4) times but you will not be required to recall it. After one presentation of the second list you will be required to write down as many of the second list as you can recall. Are there any questions?"

The S was then presented with the training list four times in a randomized order within each list and the drum was briefly stopped and the S reminded to write down the second list. The second list was then presented once and the S given two minutes to recall and write down this list. The S was verbally instructed to use all of the time to try to recall the test list. The three lists were counterbalanced in their order of presentation to equate for practice and/or fatigue effects and this experimental task was counterbalanced in order of administration with the second experimental task which was performed at the same time.

RESULTS

Mean recall data for the terms presented in the memory drum are given in Table 2, grouped according to sex, type of categorizer,

*Taken from Foley and Cofer (1943)
**Taken from Roget's Thesaurus of the English Language in Dictionary Form (1940)

and the form of association generated by the three lists. Statistical analysis of these data are contained in Table 3.

The hypothesis of greater mediated generalization was not supported by the results of this study. The only significant effect on recall was a Proactive Inhibition-like effect with the synonym list and a Proactive Facilitation-like effect on the homonym list, both factors consistent with previous paired-associate learning studies.

Table 2

Cell Means for Recall Data

Appropriate cell means for the simple effect analyses can be read directly from the interaction tables by ignoring the second level of the factor from which the simple effect was analyzed.

Sex	Male	Female	
	7.07	7.33	
Categorizers	Broad	Narrow	
	7.28	7.12	
Association	Control	Synonym	Homonym
	7.13	6.83	7.65
Sex x Categorizers	Broad	Narrow	
Male/	7.33	6.80	
Female/	7.23	7.43	
Sex x Association	Control	Synonym	Homonym
Male/	7.0	6.75	7.45
Female/	7.25	6.9	7.85
Categorizers x Association	Control	Synonym	Homonym
Broad/	7.2	6.7	7.95
Narrow/	7.05	6.95	7.35
Categorizers x Association x Sex	Control	Synonym	Homonym
Male/ Broad/	7.0	6.7	8.3
Female/ Broad/	7.4	6.7	7.6
Male/ Narrow/	7.0	6.8	6.6
Female/ Narrow/	7.1	7.1	8.1

Table 3

Analysis of "Recall" Data

Design: Three way fixed effects analysis of variance with repeated measurement over one factor (association).

Source	SS	d.f.	MS	F	Significance & $\hat{\omega}^2$
sex	2.408	1	2.408	3.69	** (.026)
categorizers	0.209	1	0.209	----	
sex x categorizers	0.008	1	0.008	----	
subjects	23.634	36	0.652		
association	0.817	2	0.409	1.02	
sex x association	0.616	2	0.308	----	
categorizers x association	0.217	2	0.109	----	
sex x categorizers x association	0.817	2	0.817	----	
association x subjects	28.866	72	0.400		
Total	57.592	119			

Significance

*	.75
**	.90
***	.95
****	.99

II. CATEGORY WIDTH AND FIELD DEPENDENCE

The second major area of investigation involved the attempt to determine the extent, if any, of the relationship between width of cognitive categorization and extent of field dependence/independence. Category width was again determined by the Pettigrew Category Width Scale. Field dependence was measured through the use of the Rod-and-Frame Test. This test, developed by Witkin (1954) has consistently shown males to be more field independent while females tend to be more field dependent. Field dependent persons utilize the limited visual field as a reference rather than the internal information provided by the vestibular receptors.

Statistics and "F" Table taken from:
Winer, B. J. Statistical Principles in Experimental Design. McGraw-Hill, New York, 1962.

METHOD

Apparatus.—The apparatus consisted of two units: (1) A wooden tiltable chair, with headrest and footrest, placed 7 ft. in front of the Rod-Frame unit. The chair could be placed in any of three positions: tilted 28° to the left, 28° to the right, or upright. (2) A rod-and-frame apparatus constructed from 1 in. sq. material. The frame was 36 in. on each side and the rod, mounted within the frame, was 33 in. long. Both the rod and the frame could be independently moved to varying orientations to the right or left of the vertical position. Scales on the back of both the rod and the frame indicated the degrees to which each was tilted. The entire apparatus was painted a flat black with the exception of the surfaces of the rod and the frame facing the S, which were painted with luminous paint.

Subjects.—Ss consisted of 20 students selected from 200 introductory psychology students who had taken the Pettigrew Category-Width Test. Ten Ss with extremely broad and ten with extremely narrow category width scores were used, with an equal number of males and females in each group. Mean category width scores for each of the groups are given in Table 4.

Table 4

Mean C-W Scores

Group	Broad	Narrow
Male	98.0	27.0
Female	89.8	20.0
Combined M & F	93.9	23.5

Procedure.—The experiment was conducted in a totally darkened room in which no objects other than the rod and the frame were available for visual reference. Ss were led into the room blindfolded and were assisted into the chair. They were instructed to tell the E which way to move the rod, and to stop when they believed the rod was in a vertical position in relation to the floor. Each S was given 24 trials, with the chair in one of the three positions, the frame tilted either 30° to the right or left, and the rod initially placed in one of four positions: 15°, 30°, 60°, or 75° to the left or right. Testing in the various positions was counterbalanced. A 30 sec. rest period was given between trials.

RESULTS

Table 5 summarizes the results of this study, showing the performance of each group of Ss in terms of the mean error from vertical in their setting of the rod.

Table 5

Mean Error Scores
(in degrees from vertical)

	Broad	Narrow	Total
Male	5.69	4.20	4.95
Female	7.47	11.56	9.52
Total	6.58	7.88	

These data provide support for the hypothesis that broad categorizers would manifest a higher degree of field independence, as indicated by superior performance on the Rod-and-Frame Test.

An interesting feature of these data, however, is a significant interaction between category width and sex. Narrow male categorizers did slightly better on the R-F Test than did broad male categorizers. Narrow female categorizers, by contrast, did much poorer on the R-F Test than broad female categorizers. It must be recognized however, that the number of subjects in each category is quite small (N = 5 per category) and this pattern would not necessarily be maintained for a larger group of Ss.

III. CATEGORY WIDTH AND THE LEARNING OF MULTI-ATTRIBUTE PAIRED ASSOCIATES

The problem of primary concern for the present study was to determine what the S does when he is confronted with a learning task in which he is at liberty to choose from a variety of stimulus attributes in a P-A learning task. More specifically, the question was: Does a broad categorizer select and "process" a quantitatively greater amount of stimulus data than does a narrow categorizer?

Other studies (Weiss & Margolius, 1954; Underwood, 1962; Parsons, 1968) have shown that the functional stimulus is consistently that which is most meaningful to the S. The present investigation did not consider the Ss choice of functional stimulus, but rather attempted to determine if the amount of information processed could be predicted from the S's category width score.

Put in another way, the hypothesis tested in this study suggested that broad categorizers would "process" a greater quantity of input data than would narrow categorizers.

METHOD

Subjects

Two groups of subjects were used, the extremely broad and the extremely narrow categorizers. Category width was operationally defined as the score obtained on the Pettigrew (1958) Category Width Scale. From approximately 250 undergraduate students to whom the scale had been administered, the 24 with the most extreme scores were selected, six males and six females in each group. Four possible categories were thus established. The mean C-W score for the four categories, plus those of the combined groups, are shown in Table 6.

Table 6

Mean *N* Scores

Group	Broad	Narrow
Male	92.5	26.1
Female	82.3	32.1
Combined M & F	87.4	29.1

The tendency for males to be broader categorizers (consistently found by Pettigrew and other investigators) is seen at the broad end of the continuum. At the opposite extreme, however, the males also have the more extreme scores, contrary to prior expectations, suggesting that males may tend toward greater cognitive heterogeneity than females. (Means for the entire group of students were 64.35 for the males and 57.37 for the females, which is highly consistent with the sex-related difference found by Pettigrew.)

Although many investigations of cognitive categorization have stressed the male-female differences, it would appear, as subsequent data will indicate, that the breadth of categorization per se is more significant for this study than the male-female dimension. This doubtless may be attributed to the use of only the extreme C-W scores.

Apparatus and Materials

Materials for the P-A learning task consisted of stimulus figures and response CVCs mounted on 5 X 18 in. cards for manual presentation. The stimulus figure possessed four distinct attributes. A 7% association value nonsense syllable made of block letters cut from colored construction paper was mounted on a contrasting colored background in the shape of a geometric figure. The four stimulus attributes therefore were:

a) The CVC
b) The color of the CVC
c) The background shape
d) The background color

Response CVCs consisted simply of black letters mounted on a white background. These were also of 7% association value from the Glaze (1928) list. Characteristics of both S and R materials are given in Table 7.

The apparatus used in this investigation was identical to that utilized in previous research (Parsons, 1968) and described more fully in a report of that study. A 4 X 3 ft. vertically mounted Masonite screen with two 5 X 8 in. apertures in the center was fitted with sliding shutters which were controlled by E. The P-A cards were presented using the apparatus which enabled the S to first view the stimulus figure, then, 3 sec later, to see both the stimulus and the response. During the backward recall trials, only the response side was opened.

Table 7

Attributes of S and R Materials

Stimulus				Response
CVC	CVC Color	Background Shape	Background Color	
DAQ	Gray	Triangle	Dk. Green	
BOF	Dk. Blue	Trapezoid	Pink	
ZIH	Maroon	Cross	Yellow	
CEJ	Lt. Blue	Diamond	Brown	
QAS	Lt. Green	Circle	Med. Blue	KEB
MIB	Purple	Star	Orange	GUK
FUH	Brown	Square	Red	ZEG

Procedure

After forming the two groups of Ss by means of the C-W pretest, each S was tested individually in the P-A learning task. The S was seated about 6 ft. from the apparatus, and E read verbatim the following instructions:

> This is an experiment in paired-associate learning. Your task is to learn the correct response to each of seven stimuli. On the left side will be the stimulus, and on the right the response, a three-letter nonsense syllable. I will first show you all seven pairs, for about 5 seconds each. Then the response side will be closed and the stimulus will appear for 3 seconds. Try to remember the response and spell it out loud before it appears. We will go through the seven pairs until you have correctly anticipated and spelled out all seven nonsense syllable responses. The order in which the cards appear will be different each time, so don't try to learn the response by remembering the order. Criterion for completing the experiment will be two successive errorless trials.

No verbal cues as to the number of stimulus attributes available or which should be utilized were given in the instructions. The stimulus followed by the S-R pair were presented at a 3 : 3 sec rate with a 6 sec interpair interval and a 30 sec intertrial interval.

Immediately after the S reached criterion he was informed that he would now be shown the seven responses and asked some questions about the stimulus side. As each response CVC appeared in the apparatus, S was asked if he could recall: a) what the stimulus CVC was, b) the color of the CVC letters, c) the shape of the background figure, and d) the color of the background. Responses were recorded on prepared data sheets.

Finally, each S was asked to describe, if he could, the procedure he used in forming the P-A associations.

RESULTS

The primary measure by which the results were evaluated was the total number of stimulus attributes recalled by each S. Comparisons were made of the performance of the broad versus the narrow categorizers, as well as of the male versus female groups.

Analysis of the number of trials to criterion indicates that neither the difference between the broad versus narrow group ($\bar{X}_B$=12, $\bar{X}_N$=14, df=22, t=1.25) nor the male versus female group ($\bar{X}_M$=12.1, $\bar{X}_F$=13.5, df=22, t=.97) is significant. Rate of learning in this task, therefore, appears to be influenced neither by sex nor by breadth of categorization.

When, however, we look at the number and diversity of associations which S formed during the learning process, and at the amount of recall, some striking differences appear. Table 8 shows the total number of stimulus attributes recalled, by groups. The maximum number of attributes, it will be recalled, is 28, with 4 attributes for each of the 7 stimuli.

Table 8

Mean Number of Attributes Recalled

Group	N of Ss	Amt. of Recall
Male, Narrow	6	6.7
Female, Narrow	6	6.8
Male, Broad	6	13.8
Female, Broad	6	12.7
Male: Combined B & N	12	10.2
Female: Combined B & N	12	9.7
M. & F.: Broad	12	13.3
M. & F.: Narrow	12	6.7

These data indicate that the differences between the males and females at both the broad and narrow ends of the C-W continuum are not significant. Comparison of differences between broad and narrow categorizers, however, in this learning task, reveals a highly significant difference. The broad categorizers were able to recall almost exactly double (13.3 versus 6.7) the number of attributes that the narrows recalled.

An examination of the recall data reveals apparent variations in the learning process which may account for the highly significant differences in the amount of information retained, despite little difference in the rate of learning. The narrow categorizers evidently quickly focused on one primary stimulus attribute, and largely ignored the remaining attributes, while the broad categorizers were more broadly attuned to the various stimuli present.

The difference in the manner of processing the stimulus data is seen in the number of occasions in which Ss were able to recall two or more of the four attributes of a particular stimulus. On 51 recall trials (out of 84) the broad categorizers recalled 2 or more of the attributes, for a mean of 4.25 trials per person. Narrow categorizers recalled 2 or more attributes on 24 trials, for a mean of 2. On 26 trials the broad categorizers recalled three or more attributes, while on only 8 trials did the narrow categorizers recall 3 or more. On 7 recall trials broad categorizers correctly identified all four stimulus attributes, while no narrow categorizers succeeded in this. These data

are summarized in Table 9.

Table 9

Recall of Multiple Attributes

Attributes Recalled	No. of Recall Trials	
	Broad	Narrow
Two	51	24
Three	26	8
Four	7	0

DISCUSSION

A certain distinct form of "cognitive attitude," whose influence is seen in performance on the C-W Scale, appears to differentiate between a broad and a narrow categorizer in his approach to the type of P-A learning task which has been investigated.

The data obtained in this study clearly support the hypothesis that a greater quantity of stimulus attributes will be cognitively processed and retained by broad categorizers. Not only did they recall a larger and more diverse set of attributes, but they also appeared to structure the learning task differently. In a situation presenting a degree of ambiguity (i.e. several attributes from which to choose), the narrow categorizers reacted in characteristically conservative manner, just as on the C-W Scale their responses tended to be much more conservative. In the learning task, their conservativism took the form of narrowing their perceptual selectivity to include only the minimal quantity of functional stimuli needed to form the required associations.

Somewhat analogous to the Taylor and Levitt (1967) finding that broad categorizers prefer a greater variety of stimuli than do narrow categorizers, the data of the present study suggest that broad categorizers utilize a greater diversity of available stimuli in a learning task.

The difference between the two groups in attribute recall, while predicted by the hypothesis, was surprisingly large, especially in view of the close similarity in number of trials to criterion. The two groups appear not to differ significantly in general intelligence. An I.Q. test was not administered, but the g.p.a. of the groups, while slightly higher for the broad group, did not differ significantly. Furthermore, other studies have indicated that breadth of categorization is not appreciably correlated with measures of intelligence. The primary difference was in the procedure by which the Ss of each group approached the task at hand, and in the manner in which he formed the required associations.

When each S was questioned at the conclusion of his participation in the experiment, he was asked how he had formed the associations to learn each pair. While both the S's reports and E's interpretations are at this point highly subjective, the differences in the two groups' [illegible] of their tactics were very apparent. The majority of the narrow categorizers reported that they "just tried to remember the nonsense syllables," or the colors, or the background shapes. By contrast, the broad categorizers reported a wide variety of associations which they utilized. The degree of versatility and imagination used by this group was in marked contrast to the essentially rote processes of the narrow C-W group.

The results obtained in this study appear to contradict the findings of some previous investigations, such as that of Messick and Damarin (1964), who found narrow categorizers better in a facial recognition task, or of Messick and Fritzky (1963), who report that the narrow categorizer superior in a Memory for Design Test. A difference, however, between the present study and the above-mentioned ones is that this study involved a learning task. It may well be that the narrow categorizer, being more conservative in his cognitive orientation, immediately focuses more intensely on the task at hand, while the broad categorizers orient themselves more diversely to the total array of the attributes presented by the situation. The present findings, moreover, are consistent with the reports that field-independent Ss--who also tend toward broad C-W scores--excel in the recall of formal properties of designs composed of several elements (Messick & Fritzky, 1963).

CONCLUSIONS

The three major areas of research described in this report have been investigated with the intent of gaining additional insight into the effect which individual differences in cognitive conceptualization exert on certain other behaviors. Cognitive category width--operationally defined as the score obtained on the Pettigrew Category-Width Scale--was found to be functionally related to certain types of mental tasks, but not to others. Stimulus generalization, either perceptually or through verbal mediation, was not found significantly related to width of categorization. A second study found broad categorizers to be somewhat more field independent in a Rod-and-Frame Test. There was, however, a significant interaction between sex and category width. The third area of investigation, and that most directly related to the learning process, found highly significant differences between broad and narrow categorizers in the learning of multi-attribute paired associates.

From the data of these studies, certain conclusions appear warranted.

1. Performance in a simple perception task does not appear to be a significant function of category-width per se, at least not in a pervasive manner. Certain types of perceptual operations may indeed, as some studies suggest, reflect the differential cognitive processes which are measured by category-width.

2. Generalizations regarding the relation between category width and field dependence must at this point remain inconclusive. Category width is largely an internal means of organizing and ordering cognitive data, whereas field dependence, as measured by the Rod-and-Frame Test involves both internal sensory data and the influence of the external visual field. Thus the relationships between the two variables may remain only minimally associated.

3. When a learning task provides the opportunity for the utilization of varying quantities of input information, as in the multi-attribute paired-associate task, the variable produced by differences in category width appears to play a highly significant role.

Recommendations.--Certain suggestions for further research growing out of the study reported herein may be made.

The goal of determining at what stage in the developmental process male-female differences first appear was not attained. Attempts to develop a valid and adequate instrument to diagnose the variables leading to such differential cognitive development were, perhaps temporarily abandoned. Reasons for this were twofold. First, it became apparent that category-width differences between males and females, while consistently present, accounted for only a small part of the total variance in breadth of categorization, and that category width differences, per se, were more significant in influencing behavioral variations than were the differences between males and females in this process. Second, the number and diversity of possible influences

leading to sex-related differences in category width proved to be so great that attempts to analyze the relative influence of each, even through sensitive multi-variate analysis techniques, were not able to be fulfilled. The early hypothesis, that variations in the degree of permissiveness--restrictiveness, while very likely involved, is almost certainly not the only factor leading to sex-related differences. Further study in the area of developmental factors should not, however, be neglected, and could well lead to some significant findings relevant to the learning process.

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APPENDIX A

The following pages contain a sample of the Pettigrew Category-Width Scale, which has been demonstrated to reliably measure individual differences in cognitive categorization.

THE PETTIGREW C-W SCALE

1. It has been estimated that the average width of windows is 34 inches. What do you think:

a. is the width of the widest window . . .

1.	1,363 inches	3.	48 inches
2.	341 inches	4.	81 inches

b. is the width of the narrowest window . . .

1.	3 inches	3.	11 inches
2.	18 inches	4.	1 inch

2. Ornithologists tell us that the best guess of the average speed of birds in flight would be about 17 m.p.h. What do you think:

a. is the speed in flight of the fastest bird . . .

1.	25 m.p.h.	3.	73 m.p.h.
2.	105 m.p.h.	4.	34 m.p.h.

b. is the speed in flight of the slowest bird . . .

1.	10 m.p.h.	3.	12 m.p.h.
2.	2 m.p.h.	4.	5 m.p.h.

3. The average length of whales in the Atlantic Ocean has been estimated by zoologists to be roughly 65 feet. What do you think:

a. is the length of the longest whale in the Atlantic Ocean . . .

1.	120 feet	3.	86 feet
2.	190 feet	4.	75 feet

b. is the length of the shortest whale in the Atlantic Ocean . . .

1.	6 feet	3.	52 feet
2.	43 feet	4.	21 feet

4. Shipping authorities have calculated that the average weight of merchant ships registered with the U.S. Maritime Commission in 1946 was 5,705 tons. What do you think:

a. is the weight of the heaviest ship registerd with the commission . . .

1.	10,500 tons	3.	23,000 tons
2.	62,000 tons	4.	7,500 tons

b. is the weight of the lightest ship registered with the commission . . .

1.	3,900 tons	3.	2,700 tons
2.	1,100 tons	4.	2 tons

5. Weather officials report that during this century Washington, D.C., has received an average rainfall of 41.1 inches annually. What do you think:

a. is the largest amount of rain that Washington has received in a single year during this century . . .

1.	82.4 inches	3.	63.7 inches
2.	45.8 inches	4.	51.2 inches

b. is the smallest amount of rain that Washington has received in a single year during this century . . .

1.	20.2 inches	3.	9.9 inches
2.	36.3 inches	4.	29.7 inches

6. An average of 53 ships entered or left New York harbor daily during the period from 1950 through 1955. What do you think:

a. was the largest number of ships to enter or leave New York in a single day during this period . . .

1.	69 ships	3.	76 ships
2.	153 ships	4.	102 ships

b. was the smallest number of ships to enter or leave New York in a single day during this period . . .

1.	34 ships	3.	16 ships
2.	3 ships	4.	43 ships

7. For the past twenty years, Alaska's population has increased an average of 3,210 people per year. What do you think:

a. was the greatest increase in Alaska's population in a single year during these twenty years . . .

1.	6,300	3.	3,900
2.	21,500	4.	4,800

b. was the smallest increase in Alaska's population in a single year during these twenty years . . .

1.	470	3.	980
2.	1,960	4.	2,520

8. Boating experts estimate that the average speed of all sailing craft in America is around 4.1 knots. What do you think:

a. is the speed of the fastest sailing boat in America . . .

1.	8.2 knots	3.	5.9 knots
2.	30.7 knots	4.	21.3 knots

b. is the speed of the slowest sailing boat in America . . .

1.	3.3 knots	3.	2.2 knots
2.	0.6 knots	4.	1.2 knots

9. Book review editors guess that around 300 new American novels have appeared annually since World War II. What do you think:

a. is the largest number of novels to be published in America in a single year during this period. . .

1.	380 novels	3.	870 novels
2.	495 novels	4.	620 novels

b. is the smallest number of novels to be published in America in a single year during this period . . .

1.	145 novels	3.	90 novels
2.	205 novels	4.	260 novels

10. Between 1900 and 1940 there was an average of 48 lynchings per year in the United States. What do you think:

a. was the largest number of lynchings in any one year during this period in the United States . . .

1.	79	3.	53
2.	63	4.	153

b. was the smallest number of lynchings in any one year during this period in the United States . . .

1.	1	3.	33
2.	11	4.	19

11. It has been calculated that the average time for all trains in 1953 from New York City to Washington, D.C., was 285 minutes (4 hours and 45 minutes). What do you think:

a. was the time of the slowest train from New York City to Washington in 1953 . . .

1. 337 min. 3. 396 min.
2. 304 min. 4. 483 min.

b. was the time of the fastest train from New York City to Washington in 1953 . . .

1. 236 min. 3. 268 min.
2. 202 min. 4. 145 min.

12. The average number of births in the world per day during 1955 has been computed to be 27,440. What do you think:

a. was the largest number of births in the world in any one day during 1955 . . .

1. 36,501 3. 49,876
2. 28,207 4. 30,023

b. was the smallest number of births in the world in any one day during 1955 . . .

1. 26,340 3. 14,330
2. 24,725 4. 19,704

13. When all of the world's written languages are considered, linguists tell us that the average number of verbs per language must be somewhere around 15,000. What do you think:

a. is the largest number of verbs in any single language . . .

1. 21,000 3. 50,000
2. 18,000 4. 30,000

b. is the smallest number of verbs in any single language . . .

1. 1,000 3. 5,000
2. 13,000 4. 10,000

14. The average muzzle to tail length of a sample of 1,000 German Shepherd dogs is 40.3 inches. What do you think:

a. is the length of the longest Shepherd dog in the sample . . .

1. 60.4 inches 3. 44.1 inches
2. 47.8 inches 4. 54.2 inches

b. is the length of the shortest Shepherd dog in the sample . . .

1. 34.6 inches 3. 19.7 inches
2. 28.4 inches 4. 36.9 inches

15. The average population of South American countries is approximately 8.6 million people each. What do you think:

a. is the population of the most populated country in South America . . .

1. 11.2 million 3. 23.6 million
2. 54.7 million 4. 129.1 million

b. is the population of the least populated country in South America . . .

1. 7,000 3. 2.4 million
2. 6.2 million 4. 29,000

16. A Stanford University home economist has estimated that the average American spends around 55 minutes of his day eating. What do you think:

a. is the longest eating time of any single American . . .

1.	185 minutes	3.	245 minutes
2.	125 minutes	4.	90 minutes

b. is the shortest eating time of any single American . . .

1.	16 minutes	3.	38 minutes
2.	4 minutes	4.	27 minutes

17. In 1946 the average number of births per state was 6,800. What do you think:

a. was the highest number of births in a single state . . .

1.	87,000	3.	71,000
2.	122,000	4.	254,000

b. was the lowest number of births in a single state . . .

1.	29,000	3.	14,000
2.	53,000	4.	900

18. Immediately after World War II, the average number of submarines owned by the largest seven navies in the world was 58. What do you think:

a. was the largest number of submarines owned by one of these navies . . .

1.	159	3.	118
2.	91	4.	69

b. was the smallest number of submarines owned by one of these navies . . .

1.	22	3.	36
2.	9	4.	47

19. The average number of churches per religious denomination in the United States is estimated to be 511. What do you think:

a. is the largest number of churches of a single religious denomination in the U.S.A. . . .

1.	4,833	3.	1,219
2.	757	4.	39,801

b. is the smallest number of churches of a single religious denomination in the U.S.A. . . .

1.	313	3.	1
2.	146	4.	23

20. In the years 1916 through 1946, according to the U.S. Weather Bureau, there was an average of 140 tornadoes a year in the United States. What do you think:

a. was the largest number of tornadoes in a single year in the United States during this period . . .

1.	154	3.	312
2.	243	4.	197

b. was the smallest number of tornadoes in a single year in the United States during this period . . .

1.	103	3.	61
2.	122	4.	28