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# Sex differences in concept identification.

Valerie Holland

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SEX DIFFERENCES IN CONCEPT IDENTIFICATION

by

Valerie Holland

A Thesis

Presented to the Graduate Committee

of Lehigh University

in Candidacy for the Degree of

Master of Science

in

Psychology

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May 30, 1976  
(date)

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## Table of Contents

	<u>Page</u>
Abstract . . . . .	1
Introduction . . . . .	2
Method . . . . .	10
Subjects . . . . .	10
Stimuli . . . . .	10
Task . . . . .	11
Design . . . . .	12
Results . . . . .	13
Discussion . . . . .	17
Footnotes . . . . .	22
References . . . . .	23
Vita . . . . .	26

List of Tables

<u>Table</u>		<u>Page</u>
1	Mean Number of Errors for Males and Females as a Function of Task Complexity and Prob- lem Number . . . . .	14
2	Analysis of Variance on Performance Scores . .	15

List of Figures

<u>Figure</u>		<u>Page</u>
1	Sex X Problem Number Interaction . . . . .	16

## Abstract

The present experiment investigated possible sex differences in performance by college students on a concept identification task. All subjects received two concept identification problems consisting of stimuli which varied along six bilevelled dimensions. The solution consisted of a conjunctive concept, based on two relevant dimensions. Subjects were assigned to one of three possible conditions of task complexity, which were determined by the number of irrelevant dimensions present in each problem. Although the main effect of sex of subject did not attain significance, males performed significantly better than females on the first problem. This difference in performance scores did not appear on the second problem. There was no significant interaction between sex of subject and task complexity. The results are interpreted to suggest that males may have an initial advantage in solving this type of task as a result of earlier experiences which required similar skills.

## Introduction

Although the investigation of sex differences in intellectual abilities has become a popular topic of research in the past several years (Maccoby and Jacklin, 1974), little systematic attempt has been made to examine the relationship between the sex of a subject and performance on a typical concept identification task (Bruner, Goodnow, and Austin, 1956). The concept identification or concept formation task has been considered by some researchers to be a keystone to understanding just how humans think (Bruner, Goodnow and Austin, 1956; Thomson, 1959, Vinacke, 1952; Smoke, 1935) and, therefore, has been the topic of considerable investigation by many experimental psychologists over the past 25 years. According to Smoke, concept formation, generalization, or concept learning all refer to "the process whereby an organism develops a symbolic response (not necessarily linguistic) which is made to the members of a class of stimuli patterns but not to other stimuli" (p. 274). Bruner and his associates suggest that individuals decide whether an item belongs to a certain class by discriminating readily identifiable attributes and thereby coming to recognize what defining attributes any stimulus must have in order to be an instance of a

particular concept. An attribute is "any discriminable feature which is susceptible to variation from instance to instance." (Thomson, p. 68) Therefore, in the typical concept identification task subjects are required to ascertain which attributes must exist as a part of the stimulus complex in order for that stimulus to be classified in one category rather than another; most frequently the categories are assigned labels by the experimenter, such as "correct or incorrect," or "A or B."

The relationship of such a task to the thought processes in humans is obvious. At a young age children begin to distinguish familiar people from strangers and act accordingly. Piaget has suggested that by age 2 a child has learned to construct the notion of a permanent object even though the object may not be visible; this implies that the child has a concept of the object. Furthermore, he argues that the ability of a child to form such a concept, and at a later age, the ability to classify objects are integral to intellectual development (1950).

If we assume that concept formation is an important part of intellectual functioning, then it seems reasonable to ask why researchers have not attempted to collect data on potential sex differences in performance in this area. One possible explanation for this lack of data may rest in the fact that most of the research in the area was carried out before 1965, at a time when the implicit assumption was

often made that learning processes are identical for men and women. Recently, however, clear sex differences in performance have been noted on such cognitive tasks as problem-solving (Maier and Casselman, 1970), and on tests of field independence (Bogo, Winget, and Gleser, 1970; Morf, Kavanaugh, and McConville, 1971, Gerace and Caldwell, 1971). As Maccoby and Jacklin have observed, "It is well known that males tend to score higher than females on tests of field independence. It has been alleged that field independence forms part of a larger cluster of abilities, sometimes called analytic abilities. A field-independent individual is alleged to be skilled in a large range of tasks that require ignoring a task-irrelevant context or focusing upon only selected elements of a stimulus display." (p. 104)

Results of previous studies have shown that both field independence and cognitive style are related to performance on concept attainment tasks. Dickstein (1968) found that subjects who scored high on a measure of field independence were significantly more efficient in their performance on a concept attainment task as measured by the number of choices to solution. Hester and Tagatz (1971) gathered data which demonstrated that subjects who were categorized as analytic according to the Tagatz Information Processing Scale to measure cognitive style were initially more efficient on concept attainment tasks. Since

males tend to score higher than females on measures of both field independence and analytic abilities, it seems quite possible that they may also perform better than females on measures of concept formation.

Maier and Casselman seem to be talking about a process similar to field independence when they note that female subjects have greater difficulty than male subjects in solving problems which require recognizing "essential differences" which prevent accepting a wrong answer (p. 116). In their studies, Maier and Casselman presented their subjects with written problems describing various situations. These descriptions included information which was necessary in order to solve the problem correctly, as well as irrelevant information which may serve to confuse the subject, and thus hinder the attainment of a correct solution. Females seem to make more errors on such problems. When the incorrect answers given by the female subjects were examined closely, it was discovered that their answers could only be obtained by using the irrelevant information provided in the problem to perform various mathematical operations on the relevant information that was given. The mathematical operations performed by the female subjects were correct, but they appeared to have difficulty deciding which information ought to be included in their attempt to solve the problems. Although the investigators performed a similar analysis on the incorrect

answers provided by the male subjects, they were unable to find a consistent pattern of wrong answers selected by male subjects. It was this pattern in the responses of female subjects which suggested to Maier and Casselman that females have difficulty recognizing essential differences between information which ought to be included in the solution process, and information which was unnecessary in order to solve the problems presented. In this case, recognizing essential differences refers to the ability of a subject to discard irrelevant information which may otherwise lead a subject to accept an incorrect solution to a verbal problem.

The ability to distinguish between relevant and irrelevant cues in a stimulus display is central to formulating a correct hypothesis which leads to solution in a concept identification task. In this case, the subject is presented with cards containing stimuli which vary along numerous dimensions, and which supply numerous bits of information. The subject usually attempts to classify the stimuli as correct or incorrect depending on which hypothesis he or she has formulated as a result of feedback from the experimenter. Thus, it is the task of the subject to ascertain which particular dimension, and therefore, what particular bit of information is contained on a "correct" card. Subjects who perform well on this task seem to quickly separate the bits of information which are

critical to the correct solution from the bits of information which may suggest alternate, incorrect hypotheses. If females have greater difficulty discarding irrelevant information, as Maier and Casselman have proposed, this difficulty may also manifest itself in the concept identification task. Elkind, Kogler, and Go (1963) have postulated that field independence is an asset on tests that require perceptual concept formation, such as the Gottschaldt Embedded Figures Test in which the subject must perform an extraction of specific elements and relations from the stimulus complex.

Furthermore, it may be argued that increasing the amount of irrelevant information should differentially affect the difficulty of the task for males and females. Several researchers have found that increasing the number of irrelevant dimensions in a problem has a significant negative effect on performance (Brown and Archer, 1956; Baggely, Havas, and Stanners, 1959). Osler and Trautman (1961) have hypothesized that these findings are due to the increasing complexity of the stimuli, which lead subjects to generate more hypotheses than they would be able to form with simpler stimuli. Thus the performance of female subjects may deteriorate more rapidly than that of males across the increased levels of task complexity, due to an increase in the amount of information contained in the stimuli which may distract the subjects. In such a

case of stimulus complexity all subjects are provided with considerably more irrelevant information than relevant information on each stimulus card. Consequently, there are a greater number of potential incorrect hypotheses which may be formulated based on irrelevant dimensions. Furthermore, since most concept identification tasks are designed in a manner which assures that the irrelevant dimensions are partially reinforced by the experimenter, all subjects have some logical grounds for generating a number of incorrect hypotheses.

Most of the research in concept identification has been characterized by the use of a pre-training phase. This procedure is usually carried out to insure that the apparent effects of the manipulation are not confounded with individual differences in acquisition. Nevertheless, the way pre-training is usually implemented by the experimenter seems to have a clear effect on later performance on the task. White, Richards, and Reynolds (1971) found a significant inverse relationship between the number of pretraining problems given and the average number of trials subjects needed to attain criterion. This suggests that the pretraining phase may afford subjects the opportunity to learn how to solve this type of task. Therefore, in this experiment it seems appropriate to examine the data from the learning phase, since differences in performance between males and females may be due to practice with

related tasks, rather than any inherent perceptual or cognitive abilities. If female subjects have to learn the process of how one solves this type of a problem, then we may expect to see a change in their behavior with increased practice, while we would expect less of a change in the performance of male subjects who may have already had some experience with similar types of tasks. As Bernard (1973) has stated, throughout childhood, and even into adolescence, "Boys appear to be more analytical, independent, and more tenacious in problem situations than are girls" (p. 139). It is moot to argue whether they are more analytic because they are socialized to deal with situations which require related abilities (i.e., assembling various abstract structures with erector sets, dismantling machinery), or whether they seek out such tasks because they find them enjoyable, due to an inherent aptitude for such tasks. In either case, most males in our society have had greater exposure to certain types of problems than females. This difference becomes even more apparent when we examine the ratio of male-to-female students enrolled in building, repairing, and mechanics courses in high schools. The trend continues in colleges which tend to have many more men than women enrolled in engineering and physics courses than women.

In their research on concept attainment, Forgas and Fowler (1957) found that concepts based on past experience are most readily attained. Assuming that the experiences

which males and females have prior to their performance in a psychological experiment on concept identification do differ along the lines of traditional sex-role stereotypes, and the previous experiences of male subjects are relevant to the skills necessary to solve a concept identification problem, then we may expect to see, at least initially, a sex difference which should decrease with practice.

The experiment reported here is designed to test whether males perform better than females on concept identification problems. Three hypotheses have been proposed. Males will tend to perform better than females on concept identification problems. The superior performance of males will become increasingly pronounced with increased levels of task complexity. With increased practice, the superior performance of male subjects over that demonstrated by female subjects will become less pronounced.

### Method

#### Subjects

The S's were 90 Lehigh University students, 45 male and 45 female, who served to satisfy an introductory psychology course requirement.<sup>1</sup>

#### Stimuli

The concept formation problems consisted of cards on which were drawn a stimulus figure. From a group of

six bilevelled dimensions, two dimensions were selected at random as relevant to the solution of a given problem. The six dimensions were color (red or green), shape (square or triangle), size (large or small), position (left or right), shading (solid or striped), and identifying number (1 or 2) which was placed directly above each figure. The large figures were 7.62 centimeters in height, and the small figures were 3.81 centimeters tall. All stimuli were drawn in ink, one to a card, on 12.7 by 20.32 cm. unlined index cards. Three levels of task complexity were used in this experiment, and they were obtained by introducing 1, 2, or 4 irrelevant dimensions, also selected at random, to each problem. If a dimension was neither relevant nor irrelevant to a given problem, only one level of that dimension would appear. At each level of complexity all possible patterns were used. The order of possible patterns within a problem was determined by a semi-random procedure with the restriction that no pattern may follow itself in the series.

### Task

Each subject was instructed and run individually. The task consisted of two problems selected from the same level of task complexity. A random procedure was used to determine the relevant and irrelevant dimensions for each problem. The solution consisted of a conjunctive concept,

based on two relevant dimensions, and the criterion of problem solution was 16 correct consecutive responses. The task was self-paced, allowing each S as much time as needed in order to make a response to each card. The instructions used were nearly identical to those used by Levine (1966). They were as follows:

"In this experiment you will be presented with two easy problems. Each problem consists of a series of cards like this one. Each card will contain a figure, and the figure will always be either a square or a triangle. Furthermore, each figure will be either red or green, solid or striped, large or small, on the left or on the right side of the card, and have either the number 1 or 2 above it. Each card will be correct or incorrect depending on the problem. For each card I want you to tell me whether you think that card is correct or incorrect, and I'll tell you whether you are right or wrong. Then we will go on to the next card, again you make a choice, and again I'll tell you whether you are right or wrong. In this way you can learn the basis for my saying 'yes' or 'no.' You can figure out which combination of dimensions form the basis for determining a correct or incorrect card. Remember the dimensions in this experiment are color, size, shape, position, shading, and number. The object for you is to figure out which dimensions are important, and to do this as soon as possible so that you can choose correctly as often as possible. Are there any questions? You may not look back through the cards you have already seen. Please flip each card over after you have responded to it."

The subjects were presented with a written list of six dimensions, and were told that they may refer to it.

### Design

A 2x2x3 factorial design was used with sex of subject, problem number, and task complexity respectively;

there were 15 S's per cell. The response measure was number of errors to criterion.

### Results

Table 1 presents the mean number of errors to criterion for each of the cells in the design, while Table 2 shows the results of an analysis of variance performed on the untransformed data.<sup>2</sup> Although males did not perform significantly better on the task than females, the difference obtained is in the predicted direction. The F's for the two other main effects--task complexity and problem number--attained significance at the .01 level. As the number of irrelevant dimensions increased, the performance of subjects declined. It is also clear from the data that subjects performed significantly better on the second problem than on the first.

The hypothesized interaction between sex of subject and task complexity failed to attain significance. While female subjects performed more poorly than male subjects under conditions of one and two irrelevant dimensions, they performed slightly better than males on the most difficult condition. There was a significant interaction ( $p < .05$ ) between sex of subject and problem order, which is indicated by Figure 1. Females tended to make more errors than males on the first problem, while male subjects made more errors on the second problem. A post-hoc comparison

Table 1

Mean Number of Errors for Males and Females as a  
Function of Task Complexity and Problem Number

	<u>Number of irrelevant dimensions</u>		
	1	2	4
<b>Males</b>			
Problem 1	10	18	37.3
Problem 2	8.4	11.2	27.5
<b>Females</b>			
Problem 1	17.9	36.4	38.6
Problem 2	7.5	13.2	19.7

Table 2  
Analysis of Variance on Performance Scores

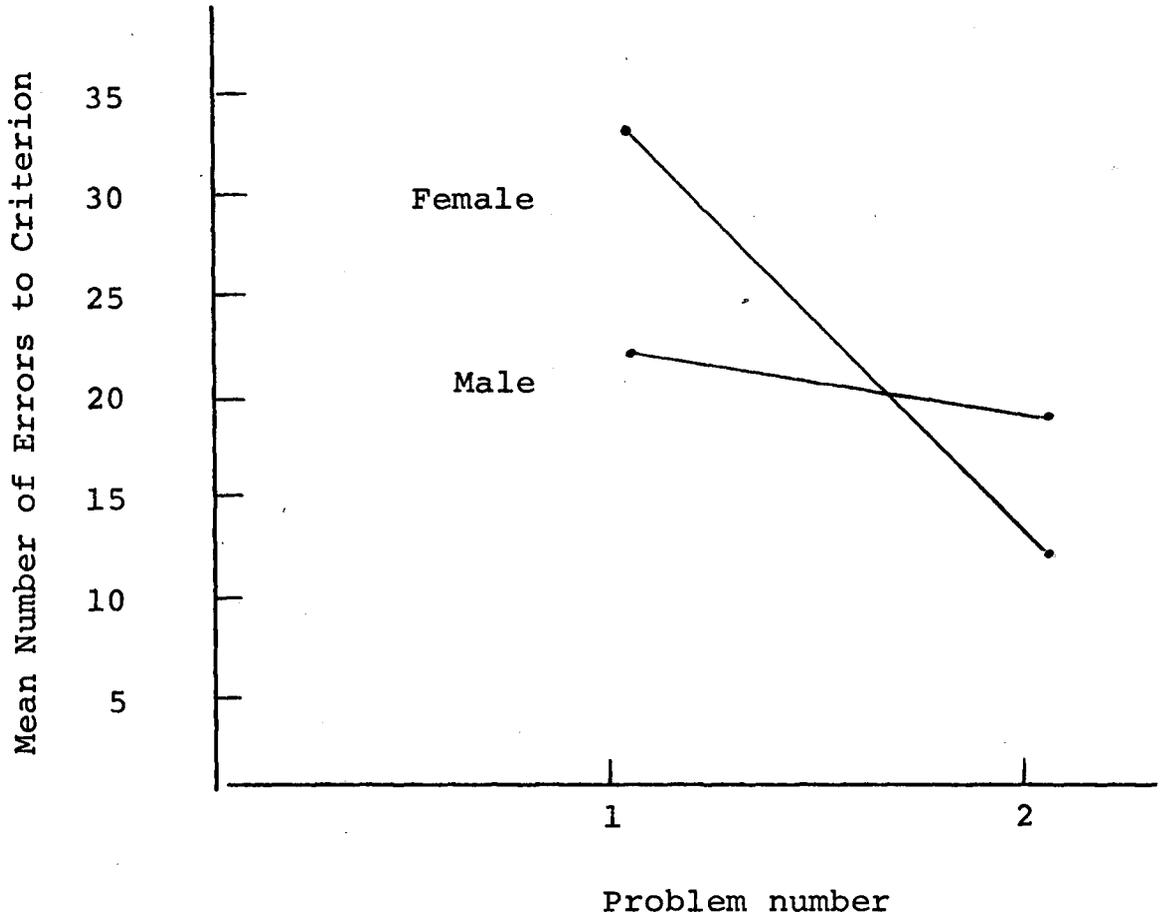
Source	df	MS	F
Sex (A)	1	547.75	.69
Task complexity (B)	2	5927.64	7.519 **
Problem number (C)	1	6242.22	7.918 **
Subjects (D)	84	788.35	
AxB	2	676.7	.858
AxC	1	1456.35	4.603 *
BxC	2	381.41	1.205
CxD	84	316.37	
AxBxC	2	71.01	.224

\*p < .05

\*\*p < .01

Figure 1

Sex X Problem Number Interaction



of means for this interaction indicated that the difference between the performance of males and females on Problem 1 was significant at the .05 level while the difference on Problem 2 failed to attain significance.

### Discussion

This study has confirmed previous findings which show that task complexity affects the performance of subjects on a bilevelled concept identification task with two relevant dimensions (Bourne, 1957). Furthermore, most subjects seemed to learn how to solve this type of problem from their exposure to the first set of stimuli; performance was significantly better on the second problem than the first.

Although the results of this experiment do not confirm the hypothesis that males perform better than females on a concept identification task, the interaction between sex of subject and number of problem suggests that males and females may bring different practiced skills into the testing session. This differential practice with various skills may be linked to the finding by Sears, Rau, and Alpert (1965) that 4 year old boys spend more time in the portion of a large nursery school play room where blocks and carpenter tools were to be found, whereas girls spent more time in the area containing dress-up clothes and doll houses. It is possible that boys' early preference for the

manipulation and assembling of abstract shapes and forms may lead to greater skill, or at least familiarity with solving problems that require attending to specific features of geometric forms. Sex differences in visual-spatial skills have also been noted at the high school level by Walberg (1969) who found that male students performed significantly better than female students on those portions of physics achievement tests which contain visual-spatial tasks. The increased skill advantage of males at performing visual-spatial tasks may be an initial advantage on the concept-identification task since this type of problem requires attending to numerous dimensions of geometric forms, and devising a system of categorizing the stimuli based on the dimensions.

The data collected in this experiment seems to indicate that any advantage males may have initially in performing the concept-identification task does decrease with practice; the difference in performance by males and females on the second problem is not statistically significant. This finding is consistent with the work of Goldstein and Chance (1965), on visual-spatial ability which shows that male students scored better on early trials, but there was no sex difference on later trials.

It is possible that the improvement of female subjects which has been noted on this type of task may be a reflection of performance anxiety. Since much psychological

research is carried out on school campuses by professors and graduate students, it is not unusual for students to perceive that their performance on the experimental task is being evaluated, just as their performance on papers and exams is frequently evaluated during the course of the semester. There is some experimental evidence which demonstrates that females show higher scores on measures of test anxiety than males, and that females tend to underestimate both their ability to perform intellectual tasks and the quality of their performance once they have performed the task (Issacson, 1964; Crandall, 1969). Furthermore, Carey (1958) found that male college students had a more positive attitude toward problem solving than did female college students. These findings suggest that the female subjects who participated in the present study may have been more anxious initially than the male subjects, and this anxiety may be interacting with performance on earlier problems. In their work on concept formation, Bruner et al. proposed that "if the objective is to reduce cognitive strain, a simpler, more easily ascertained cue will be used in preference to a more complex one of higher validity." (p. 82). Therefore, subjects who perceive stress in their attempts to solve a concept attainment problem may be induced to use a less efficient strategy in order to reduce the strain.

Since all subjects had to attain criterion on the

first problem before they were given the second problem, all subjects had some evidence that they could perform the task before they began to solve the second problem. If the females in the sample were more anxious about their ability to perform well on this task than the males, it is plausible that the positive feedback may have had a greater effect of alleviating test anxiety for the women, thereby enhancing their performance to a greater extent than would otherwise be the case.

A possible explanation for the lack of a main effect of sex differences may be found by examining the recent literature in discrimination learning which does not indicate any reliable pattern of sex differences (Odom and Mumbauer, 1971; Cairns, 1967). It is possible that concept identification may be more similar to verbal discrimination tasks, which have not uncovered any sex differences (Ratcliff and Tindall, 1970; Achenbach, 1969) than to the aforementioned problem-solving and field-independence measures. The subject in the discrimination task either must inhibit attention to irrelevant cues, avoid responding to these cues once noticed, or both. The concept identification task used in this experiment requires similar behaviors since all stimuli contain cues (in this case, dimensions) which are irrelevant to the correct solution of the problem. In order for a subject to perform well on this task, he or she has to discover which dimensions do

not provide useful information, and then inhibit responses to the irrelevant cues. Therefore, if concept identification tasks involve the same skills as verbal discrimination tasks, there should be a correlation between subjects' performances on both tasks. To date, there is no literature to suggest that such a comparison of performances has been undertaken. It would be interesting to ascertain whether the small amount of practice subjects experience with this problem in the test session has facilitating effects and perhaps even differential effects for males and females after the passage of a considerable length of time such as 6 months or 1 year.

## Footnotes

<sup>1</sup>Three male and three female subjects were dropped from the condition of 4 irrelevant dimensions for failure to solve the first problem within 30 minutes, so that a total of 96 subjects were run in order to fill the design.

<sup>2</sup>A square-root transformation was performed on the data since the measures used in this task yielded skewed distributions. The significant effects were found in the transformed data, and no new effects attained significance.

## References

- Achenbach, T.M., Cue learning, associative responding, and school performance in children. Developmental Psychology, 1969, 1, 717-25.
- Baggaley, A.R., Havas, F.W., Stanners, R.F., Effects of stimulus complexity and discriminability on concept learning. Psychological Reports, 1959, 5, 757-63.
- Bernard, H.W., Child development and learning. Boston: Allyn and Bacon, 1973.
- Bogo, N., Winget, C., & Gleser, G.C., Ego defenses and perceptual styles. Perceptual & Motor Skills, 1970, 30, 599-604.
- Bourne, L.E., Effects of delay of information feedback and task complexity on the identification of concepts, Journal of Experimental Psychology, 1957, 54, 201-7.
- Brown, F.G. & Archer, E.J., Concept identification as a function of task complexity and distribution of practice. Journal of Experimental Psychology, 1956, 52, 316-21.
- Bruner, J.S., Goodnow, J.J., & Austin, G.A., A study of thinking, New York: John Wiley and Sons, 1956.
- Cairns, R.B., Informational properties of verbal and non-verbal events. Journal of Personality & Social Psychology, 1967, 5, 353-57.
- Carey, G.L., Sex differences in problem-solving performance as a function of attitude differences. Journal of Abnormal and Social Psychology, 1958, 56, 256-60.
- Crandall, V.C., Sex differences in expectancy of intellectual and academic reinforcement. In C.P. Smith (Ed.), Achievement related motives in children, New York: Russell Sage Foundation, 1969.
- Dickstein, L.S., Field independence in concept attainment. Perceptual and Motor Skills, 1968, 27, 635-642.

- Elkind, D., Koegler, R.R. & Go, E., Field independence and concept formation, Perceptual and Motor Skills, 1963, 17, 383-86.
- Forgus, R.H. & Fowler, H., The order of dominance in concept attainment as affected by experience. Journal of Psychology, 1957, 44, 105-108.
- Gerace, T.A. & Caldwell, W.E., Perceptual distortion as a function of stimulus objects, sex, naiveté, and trials using a portable model of the Ames distorted room. Genetic Psychology Monographs, 1971, 84, 3-33.
- Goldstein, A.G., & Chance, J.E., Effects of practice on sex-related differences in performance on imbedded figures, Psychonomic Science, 1965, 3, 36.-62.
- Hester, F.M. & Tagatz, G.E., The effects of cognitive style and instructional strategy on concept attainment. Journal of General Psychology, 1971, 85, 229-237.
- Issacson, R.L., The relationships between N achievement, test anxiety and curricular choices. Journal of Abnormal and Social Psychology, 1964, 68, 447-52.
- Levine, M., Hypothesis behavior by humans during discrimination learning, Journal of Experimental Psychology, 1966, 71, 331-338.
- Macoby, E.E. & Jacklin, C.N., The psychology of sex differences, Stanford, Calif.: Stanford University Press, 1974.
- Maier, N.R.F. & Casselman, G.G., Locating the difficulty in insight problems: individual and sex differences. Psychological Reports, 1970, 26, 103-117.
- Morf, M.E., Kavanaugh, R.D. & McConville, M., Intratest and sex differences on a portable rod-and-frame test. Perceptual & Motor Skills, 1971, 32, 727-33.
- Odom, R.D. & Mumbauer, C.C., Dimensional salience and identification of the relevant dimension in problem solving: a developmental study. Developmental Psychology, 1971, 4, 135-40.
- Osler, S.F. & Fivel, M.W., Concept attainment: I. The role of age and intelligence in concept attainment by induction, Journal of Experimental Psychology, 1961, 62, 1-8.

- Osler, S.F. & Trautman, G.E., Concept attainment: II. Effect of stimulus complexity upon concept attainment at 2 levels of intelligence. Journal of Experimental Psychology, 1961, 62, 9-13.
- Piaget, J., The psychology of intelligence. London: Routledge, 1952.
- Ratcliff, R.G. & Tindall, R.C., Interaction of reward, punishment, and sex in a two-choice discrimination task with children. Developmental Psychology, 1970, 3, 150.
- Sears, R.R., Rau, L. & Alpert, R., Identification and child rearing. Stanford, Calif.: Stanford University Press, 1965.
- Smoke, K.L., The experimental approach to concept learning. Psychological Review, 1935, 42, 274-9.
- Thomson, R., The psychology of thinking, Baltimore: Penguin Books, 1959.
- Vinacke, W.E., The psychology of thinking, New York: McGraw-Hill, 1952.
- Walberg, H.J., Physics, femininity, and creativity. Developmental Psychology, 1969, 1, 47-54.
- White, R.M., Richards, D.L., & Reynolds, R. Number of pre-training problems and type of instructions in concept identification. Psychological Reports, 1971, 28, 643-49.

## Vita

Name: Valerie Holland

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After graduating from Moravian Preparatory School in 1968, I entered Oberlin College in Oberlin, Ohio, and received a Bachelor of Arts degree in psychology from there in 1972. From September 1972 until August 1973 I pursued graduate work in social psychology in the Social Relations department at Lehigh University in Bethlehem, Pennsylvania, where my studies were supported by a fellowship from the New Jersey Zinc Corporation. During this time I developed an interest in research related to interpersonal attraction, and conducted literature reviews and experiments in this area for a Master of Arts degree which I received in October 1973.

In the Fall of 1973, I enrolled in the graduate program in the Department of Psychology at Lehigh University, where I am currently pursuing the Ph.D. degree. From June until December 1974, I worked as a research assistant on an NSF project to study the potential uses of interactive cable television within a community.