A STUDY OF THE RELATIVE INFORMATION VALUE OF CONSTRUCTS IN PERSONAL CONSTRUCT THEORY

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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1954

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ACKNOWLEDGEMENTS

The writer wishes to acknowledge the major role which the interest, stimulation, and enthusiasm of his adviser, Dr. George A. Kelly, played in the execution of this research. In addition, careful reading and criticism by Dr. Julian B. Rotter and Dr. Harold B. Pepinsky helped to make this study more catholic in perspective than it might otherwise have been.

Acknowledgement is also made of the generous assistance in procuring subjects for the research given by Dr. John R. Horrocks and the instructional staff of Educational Psychology at The Ohio State University.
# Table of Contents

**List of Tables and Figures**

<table>
<thead>
<tr>
<th>List of Tables and Figures</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Chapter**

**I. Introduction and Statement of Problem**

<table>
<thead>
<tr>
<th>Introduction</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

- The problem of what constitutes an event | 1 |
- The inferential structure | 2 |
- Methodological distinctions | 4 |

- Personal Construct Theory | 5 |
- Information Theory | 7 |
- Statement of Problem | 8 |

**II. Review of the Literature**

<table>
<thead>
<tr>
<th>Studies in Information Theory</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

- Extinction Studies and Discrimination Learning | 15 |
- Studies of Intolerance of Ambiguity and Cognitive Rigidity | 20 |

- Studies in Personal Construct Theory | 23 |
- Summary | 28 |

**III. A Formal Theory Concerning the Relative Information Value of Personal Constructs**

<table>
<thead>
<tr>
<th>Definitions</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>29</td>
</tr>
</tbody>
</table>

- Information | 30 |
- Redundancy | 30 |
- Construct | 31 |
- Constellatoriness-propositionality | 31 |

<table>
<thead>
<tr>
<th>Postulates</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A Tentative Transmission Model</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>35</td>
</tr>
</tbody>
</table>

- Evaluative system | 36 |
- Self-correction | 37 |

- The assessment of information value of constructs | 38 |

**IV. Research Design and Experimental Predictions**

<table>
<thead>
<tr>
<th>Design Specifications</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>42</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operational Definitions</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>43</td>
</tr>
</tbody>
</table>

- The distinction between Co and Pr constructs | 43 |
- Construct related behavior | 43 |
- Operations for producing high and low invalidation | 44 |
Table of Contents (continued)

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of persons on Co and</td>
<td></td>
</tr>
<tr>
<td>Pr constructs</td>
<td>44</td>
</tr>
<tr>
<td>Forced reconstruction</td>
<td>45</td>
</tr>
<tr>
<td>Measures of change</td>
<td>45</td>
</tr>
<tr>
<td>Assessment of information value</td>
<td>46</td>
</tr>
<tr>
<td>Procedure</td>
<td>46</td>
</tr>
<tr>
<td>Subjects</td>
<td>46</td>
</tr>
<tr>
<td>Administration of RCRT</td>
<td>47</td>
</tr>
<tr>
<td>Individual sessions</td>
<td>48</td>
</tr>
<tr>
<td>Part I</td>
<td>48</td>
</tr>
<tr>
<td>Part II</td>
<td>49</td>
</tr>
<tr>
<td>Part III</td>
<td>50</td>
</tr>
<tr>
<td>Part IV</td>
<td>52</td>
</tr>
<tr>
<td>A methodological question</td>
<td>52</td>
</tr>
<tr>
<td>Summary</td>
<td>54</td>
</tr>
<tr>
<td>V. Results</td>
<td></td>
</tr>
<tr>
<td>Unusable Protocols</td>
<td>55</td>
</tr>
<tr>
<td>Tests of Predictions</td>
<td>56</td>
</tr>
<tr>
<td>A Test of the Consistency of Constructions on Pr and Co Constructs</td>
<td>60</td>
</tr>
<tr>
<td>VI. Discussion of Results and Implications</td>
<td>64</td>
</tr>
<tr>
<td>The Control for Bias</td>
<td>67</td>
</tr>
<tr>
<td>General Theoretical Implications</td>
<td>68</td>
</tr>
<tr>
<td>Implications for Social Psychology</td>
<td>73</td>
</tr>
<tr>
<td>Implications for Clinical Psychology</td>
<td>74</td>
</tr>
<tr>
<td>Summary</td>
<td>77</td>
</tr>
<tr>
<td>VII. Summary</td>
<td>78</td>
</tr>
<tr>
<td>Bibliography</td>
<td>81</td>
</tr>
<tr>
<td>Appendix A, Raw Data</td>
<td>84</td>
</tr>
<tr>
<td>Appendix B, Materials Used</td>
<td>90</td>
</tr>
</tbody>
</table>
List of Tables and Figures

Tables

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>Tests of Experimental Predictions..................................</td>
<td>57</td>
</tr>
<tr>
<td>Two</td>
<td>A Comparison of Amount of Consistency in Constructions of Each of Two Persons Being Construed on Co Constructs..................</td>
<td>62</td>
</tr>
<tr>
<td>Three</td>
<td>Raw Data Indicating Effects of High and Low Invalidation..........</td>
<td>85</td>
</tr>
<tr>
<td>Four</td>
<td>Changes in Predictions Following Forced Reconstruction............</td>
<td>88</td>
</tr>
<tr>
<td>Five</td>
<td>Ratings of Information Value of Co and Pr Constructs..............</td>
<td>89</td>
</tr>
</tbody>
</table>

Figures

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>A Schematic Transmission Model......................................</td>
<td>35</td>
</tr>
</tbody>
</table>
| Two | Mean Frequency of Changes in Predictions
     Plotted Against Mean Number of Changes
     in Construction for Co and Pr Constructs.................. | 59   |
Chapter One

Introduction and Statement of Problem

Introduction

Since the present study is theoretical in nature, it seems desirable at the outset that we state our position on some of the points which are currently being used to differentiate various theoretical positions. Broadly conceived, the task facing any theory, psychological or otherwise, is that of predicting or rationalizing one set of events from another set of events. Theories differ, however, in deciding what shall properly constitute the events with which they shall be concerned and in the nature of the inferential structure used in linking these events. A further basis upon which theories are differentiated from each other—particularly in psychology—is the methodology associated with their verification or the methodology most often used by workers within the particular theoretical framework.

The problem of what constitutes an event. Theories are frequently referred to as either molar or molecular depending upon the comprehensiveness of the events they treat. We would agree with Littman and Rosen (20) however, that this distinction has outlived its usefulness and has become surrounded with many confusing connotations. Whether a theory is more concerned with bar-pressing behavior or with voting behavior, there can usually be found some set of events, and some theory concerning these events, which is either more or less comprehensive than the one being labelled at the moment.
From the present point of view, we shall be concerned with any and all events which appear to the writer as important and useful in the psychological understanding of behavior. The question of whether an event belongs within the province of psychology becomes meaningless by this criterion. The proper question becomes one of whether an event can be treated psychologically. Thus the occurrence of a set of ulcers in an individual becomes a psychological event if it can be described in psychological terms, or in terms of a psychological system; it is a physiological event when it is described in physiological terms.

The inferential structure. Although there are many ways of characterizing differences in the constructs used by various theories, perhaps the most important at present is that between a theory which takes abstraction as a fundamental process of all organisms as opposed to a theory which takes this as another type of phenomenon to be explained in other terms. This seems to parallel the distinction between cognitive and noncognitive types of theories.

In the cognitive type of theory, it is assumed that the organism only responds to those aspects of its environment which it has abstracted and that its behavior is determined by the way in which these abstractions occur. The inferential structure of a cognitive type of theory contains constructs aimed at describing the nature and functioning of the organism's abstraction process. The nature of the abstractive process is inferred from observed behavior and from this inference, further inferences are made concerning other behaviors.
A noncognitive theory assumes that the animal responds to all stimuli present in the environment and that, as a function of experience or training, it begins to respond differentially to the various aspects of its environment. Behavior, in a sense, is directly determined by stimuli insofar as certain responses have been linked up with certain stimuli. This is in contrast to the cognitive approach in which behavior is determined by the organism's abstraction or perception of stimuli.

To give a more concrete example of the difference, as we see it, between a cognitive and noncognitive theory of behavior, one might take the phenomena of an organism's giving the same response in two different situations. The noncognitive theory would explain this as a case of generalisation whereby the response given in the first situation occurred in the second situation because of certain dimensional similarities inherent in the situations themselves. The problem becomes one of discerning the dimensions along which generalisation occurs. A cognitive type of theory on the other hand would explain this same phenomena as a failure on the animal's part to discriminate between the two situations. The animal responded similarly because it abstracted similar aspects from the two situations and failed to abstract the differences. The problem for the cognitive theory is one of investigating the abstractive modes of the organism.

The crucial test between these two approaches to behavior theory has not yet been made and may be a long time coming. Both approaches have led to interesting and valuable research. For our own part, however,
we shall choose to work within a generally cognitive orientation whereby we shall be interested in the ways in which the individual forms abstractions from his environment and the ways in which these abstractions affect his behavior.

**Methodological distinction.** Methodologically, theories are frequently distinguished as being either nomothetic or idiographic, and historical or ahistorical. Presumably, the first of these two distinctions differentiates between the theory which leads to general laws concerning organisms in general and the theory which leads to specific laws concerned with the individual organism. The nomothetic researcher might be characterised as taking one observation on one hundred individuals while the idiographic researcher would take one hundred observations on one individual. While we do not believe this to be a very meaningful or useful distinction, insofar as idiographic carries with it the connotation of concern for the individual and the attempt to make predictions about individuals rather than groups, our theoretical orientation would be considered an idiographic one.

The theory which leads to predictions based on knowledge of the history of the organism is termed historical; where predictions are based largely on contemporaneous variables it is called ahistorical. Such a distinction is a relative one at best, since the mere occurrence of an event immediately makes it a part of the individual's history. Our position is that one should be permitted to go as far back into the individual's history as is necessary in order to make his predictions. Indeed, from a sampling point of view, the larger the temporal span
which one encompasses in his observations, the more reliable they should be.

**Personal Construct Theory**

One of the major elements in the inferential structure of Personal Construct Theory (16) is the construct. Each individual has a repertoire of constructs by means of which he orders the world about him. They represent the dimensions along which persons and events are ordered for the individual. A temporary definition of a construct to be used until we present our formal definition would be: A way in which at least two things are alike and at the same time different from one or more other things. Constructs might be thought of as codes used by the individual to make his world more manageable; they are also the bases upon which the individual makes predictions about his world.

Construct repertoires vary inter- and intraindividually as a function of the experience of the individual. This raises certain questions, only some of which will be investigated in the present study.

Perhaps the major question involves the means by which an individual's personal construct repertoire can be described. Can a means be found by which we can, in essence, map out an individual's own unique construct repertoire in terms which will permit making predictions about his behavior? Some progress has been made in this area by means of Kelly's Role Construct Repertory Test (RCRT) (15). By means of this test we can elicit a sample of the constructs used by an individual in dealing with the significant persons in his life. However, having elicited a set of constructs, the task then becomes one of specifying relationships between them, if indeed they exist. Kelly suggests that such
relationships do exist and, further, that constructs may be ordered to certain dimensions. It is with one of these dimensions that the present study is concerned.

The dimension of constructs which concerns us here is the Propositional-Constellatory dimension. A constellatory construct is one which appears to stereotype any element subsumed by it. Once an element is placed at one end of a constellatory construct, its position on other construct dimensions also becomes fixed. An element subsumed by a propositional construct is not automatically placed in certain positions on other construct dimensions. An example of this might be given in two ways in which the construct "conservative-liberal" might be used. If it were used in a constellatory fashion, a person labelled conservative might also, by the same token, be considered reactionary, anti-labor, middle-aged, and rigid, if these happen to be other constructs in the individual's repertoire. If the same construct were used in a propositional fashion by the individual, the person labelled conservative may or may not be also labelled as reactionary, etc.

This propositional-constellatory dimension seems to carry with it implications as to the structure of construct repertoires. The implication is that constructs are not wholly independent of each other, that a correlation probably exists between them, but that each construct is not equally correlated with, or independent of other constructs in the repertoire. Thus the most constellatory construct would be the one having the highest amount of intercorrelation with other constructs in the repertoire, while the most propositional construct would be the one
having the least intercorrelation. In mathematical terms, constel-
latory constructs explain a greater portion of the variance of a given
person's construct repertoire than do propositional constructs. Thus,
if we can find some way of reliably specifying the amount of variance
in a repertoire explained by a construct, we should be able to make
certain predictions about the ways in which this construct would be
used by the individual.

Information Theory

At this point it is necessary to introduce the concept of amount
of information as defined in information theory (32). According to
this theory, the amount of information given by the occurrence of a
given alternative is proportional to the log to the base 2 of the num-
ber of equally probable alternatives. This is postulated for situations
where the alternatives are of a dichotomous or yes-no variety. Thus
where there are eight such yes-no dichotomous alternatives and only
one can be "yes", the discovery of the correct alternative automatical-
ly fixes the position on the other alternatives as "no". According to
the measure proposed, the amount of information transmitted by the occu-
rence of the correct alternative in the above situation would be three
times as much as where there are only two alternatives. From this we
might generalize and state that the amount of information conveyed by
a given response is proportional to the number of other responses which
are automatically fixed by its occurrence. 1

1. Implicit in our discussion of information is the assumption of
some type of transmission model. A schematic representation of such a
model will be presented in Chapter Three.
Statement of Problem

To return now to Personal Construct Theory, this would suggest that the construct explaining the greatest amount of variance in a given repertoire, i.e., the most constellatory construct, would convey the most information for the individual using it. Therefore, since constellatory constructs explain a greater part of the variance of an individual's construct repertoire than do propositional constructs, we should expect that if we can reliably distinguish constellatory constructs from propositional constructs, and if we can make certain postulations concerning information and behavior, we should be able to make certain predictions as to differences in behavior associated with the use of constellatory and propositional constructs. This now permits a more specific statement of the problem under investigation.

We propose to investigate the relationship between constellatory and propositional constructs, defined by a specified operational criterion, and relative information value. In order to do this we shall attempt to test the following three general propositions in which relative information value functions as an intervening variable:

1. Differential amounts of reconstruction (shifting of elements from one end of a construct dimension to the other) will occur on constellatory and propositional constructs following differential degrees of invalidation of construct related behavior.

2. Reconstruction on constellatory constructs leads to more extensive changes in related behaviors than does reconstruction on propositional constructs.
Individuals will perceive their constellatory constructs as having higher information value for them than their propositional constructs.

The testing of these propositions might be conceived of as the three objectives of this study. After a review and discussion of the pertinent literature we shall attempt to construct a miniature system from which we will then attempt to deduce hypotheses bearing on each of these objectives.
Chapter Two

Review of the Literature

Since the novel construct in this exposition is information value, and we shall wish to interpret both our own study and related studies in terms of this construct, we shall begin our review of the literature with the work done utilizing information theory in psychological research. From the general psychological literature we shall then discuss those studies which could be interpreted as involving invalidation and which have pertinence to the uses to which we shall put the concept of information. Finally, we shall conclude with a review of pertinent studies within Personal Construct Theory.

Studies in Information Theory

Although information theory had its initial formulation within the field of communications engineering (32), thanks to the efforts of such people as Wiener (37, 38), Frank (9), Miller (23, 24), and Ruesch and Bateson (31), its application to the biological and social sciences has been the subject of increasing study. While its value is yet to be determined, we would agree with Miller (24) that "the analogy....will undoubtedly stimulate insights and suggest new approaches to old problems."

The two terms with which we shall be most concerned are information and redundancy. As was stated in the introduction, information is taken as being equal to the logarithm to the base 2 of the number of equally probable alternatives in any given situation. It should be emphasized that there is no necessary relationship between information so defined and meaning.
The unit used to express the amount of information conveyed is the bit. In a situation where there are two equally probable alternatives the occurrence of one alternative carries one bit of information; if there were 16 equally probable events then the occurrence of the correct event or a message indicating the correct alternative would be worth four bits of information \((\log_2 16 = 4)\). From this we observe that, in the best Gestalt tradition, the amount of information conveyed by the occurrence of an event cannot be determined by the occurrence of that event alone, but must be based on a knowledge of the situation as a whole, i.e., the number of other events which might have occurred but didn’t.

We seldom come upon a natural situation, however, where all of the possible outcomes have an equal probability of occurrence and it is here that the concept of redundancy enters the picture. To the extent that we have prior knowledge about the arrangements in the situation and can immediately dispose of certain alternatives as less likely to occur than others, the actual occurrence of an event, or a message as to which alternative will occur, does not contain entirely new information for us; some of the message is considered information and some redundancy, information we already had about the situation.

An example within the field of psychological testing might be in order at this time.² Let us suppose that we give a person a battery of three tests each of which yields a score of passed or failed (P-F)

². This example is similar to that given by Miller (24).
only. If the tests are perfectly independent of each other, the number of possible outcomes are eight: PPP, PPF, PFP, FPP, PFF, FFP, FPF, and FFF. In such a situation three bits of information are needed to determine the person's scores or we might say that three bits of information would be transmitted to us if we were told the person's scores on the tests. If, however, two of the three tests were highly correlated so that we could predict scores on, let us say, the second test from knowledge of scores on the first test with high reliability, the number of actual alternatives are then halved since we would then only have: PPP, PPF, FFP, FFF. In this case the reporting of scores on the second test does not add anything to what we already know of the person and hence constitutes redundancy.

This situation of course would rarely occur but serves to make possible our interpretation of the correlation coefficient in terms of information value. In the above example, the perfect correlation between the first and second tests had the effect of decreasing the amount of information yielded by the occurrence of any of the outcomes since it reduced the number of possible alternatives. But this would be true only for the situation where we are interested in all three test scores as a whole.

Let us now consider two situations: (a) one where two tests of a P-F type are correlated and (b) one where they are not. If we think now of information as Wiener and Shannon have defined it, i.e., as negative entropy or order, situation (a) becomes perfectly ordered once we know the score on the first test while situation (b) requires knowledge of scores on both tests before we can consider it ordered.
Here it would appear that the presence of correlation has the effect of increasing the information-value of the first test score in situation (a) relative to the first test score in situation (b). This holds of course only for the score on the first test. When we consider the second test score in each situation, we find that the score in situation (a) has a higher amount of redundancy than does the score in situation (b), i.e., it doesn't contribute as much to the ordering of the situation.

From this we would then infer the following: Where there are two systems A and B, with high intercorrelation between the elements of system A and low intercorrelation between the elements of system B, the occurrence of any one element in system A has higher information value than does the occurrence of any one element of system B. The sum total of information for each system as a whole, however, is higher for system B than for system A. This will later serve as one of our postulates.

It is obvious that in the preceding discussion we have confined ourselves to situations where the alternatives are of an on-off, one or zero variety. In this we are following the tendency of most information theorists in setting up a binary system. Since we are to be dealing with constructs which according to Kelly are to be considered dichotomous, this should cause us no trouble and should in fact make the application of informational concepts that much easier and justifiable.

Psychological studies utilizing informational concepts to date have dealt with highly controlled laboratory problems such as the amount of material recalled as a function of the information value of the material learned initially (1,26), and the intelligibility of communication over channels with given amounts of mechanical noise as a function of the amount of information being transmitted (25).
In the first case, where subjects learned artificial languages with varying degrees of information value built into them, the amount of information retained appeared to be constant. The languages were all learned to the same criterion, but differing actual amounts of words from these languages were recalled in each case. However, when the amount recalled was translated into bits of information, the amount of information recalled was fairly constant for all languages.

In the second case (25) it was found that with a given amount of mechanical noise in the communication channel, the intelligibility of stimuli was a function of the range of alternate stimuli, i.e., of their information value.

One might infer from both of these studies that the human subject, construed as an information handling system, has a fairly stable information handling capacity. Where he is part of a communication system and where the input exceeds his capacity, a certain amount of information is lost. Such studies lead one to ask questions concerning the bases of variation in information handling capacity between individuals, the conditions of which such variation might be a function, and effects of variations in information handling capacity on the various areas of human behavior. The present study represents an initial attack on some of these problems.

Ruesch and Bateson (31) have been most active in attempting to utilize information theory in their discussion of the communications problems involved in psychiatry and psychotherapy. They stress the process of codification which they define as "the substitution of one
type of event for another, such that the event substituted shall in
some sense stand for the other" (p. 169, 31). Because of the complex-
ity of the stimuli about us, it is necessary that some order be brought
about through treating some stimuli as equivalent and others as different.
They appear to agree with Miller (23) that coding is similar, if not
identical, to abstraction in that it is a process of finding similarities
and discarding dissimilarities. One might note in passing that this
interpretation of coding is similar to Kelly's definition of a construct
cited earlier.

**Extinction Studies and Discrimination Learning**

If one interprets invalidation to mean the occurrence of an event
contrary to that which might have been predicted, then studies involv­
ing experimental extinction and discrimination learning involving re­
versed pretraining become relevant.

The usual course of events in a classical conditioning experiment
is for the subject to be subjected to several pairings of the conditioned
and unconditioned stimulus until such time as he begins to give the same
or a similar response to the conditioned stimulus as that which he gave
to the unconditioned stimulus. Following the organism's having reached
the desired criterion of conditioning, the response is extinguished by
a large number of presentations of the conditioned stimulus alone. The
number of such presentations required to bring about extinction, i.e.,
the non-occurrence of the conditioned response, was taken as one measure
of the strength of the habit which had been established.

During the 1930's and onward, a distinction was made between
"partial" and "100%" reinforcement. In the latter case, reinforcement occurs on every trial while in the former, only on a specified percentage of trials. Jenkins and Stanley (14) in their review of these studies note that while acquisition of responses progressed more rapidly under 100% reinforcement, resistance to extinction was greater under partial reinforcement. This was presented as a problem to those learning theorists who assumed a linear relationship between number of reinforcements and resistance to extinction. Various attempts have been made to rationalize these findings and we should now like to present an interpretation in terms of information theory.

Let us represent the occurrence of a stimulus, either the CS or the UCS, by 1, and the non-occurrence by 0. Potentially then, there are four possible outcomes, 11, 10, 01, and 00. Actually there are only two, 11, and 10; the CS always occurs since its occurrence defines a trial, and the UCS may or may not occur. Thus the only problem is that of predicting whether the UCS will be 1 or 0. To solve this, one bit of information is required.

Now let us return to the 100% reinforcement situation as contrasted with the partial reinforcement situation. In 100% reinforcement, the CS carries the one bit of information required since its occurrence always signifies that the UCS will occur. This is not the case in the partial reinforcement situation. Since the occurrence or non-occurrence of the UCS cannot be reliably predicted from the CS, we seem justified in concluding that the CS in partial reinforcement conveys something less than one bit of information.
Now what shall we say that the animal learns in such a situation? We propose along with Bateson (4) that we have here a deutero learning situation. The animal not only learns that the CS will be followed by the UCS, he also learns how much "faith" to put in predictions based on the occurrence of the CS, i.e., he learns in the case of 100% reinforcement that he can put a great deal of "faith" in his predictions while in the partial reinforcement situation he learns to put less "faith" in his predictions.３ Phrased another way, during the conditioning process, under 100% reinforcement the CS gains higher information value than under partial reinforcement. Thus, when extinction is attempted, i.e., when his predictions are invalidated, he is in the position of learning now that the occurrence of the CS will always be followed by the non-occurrence of the UCS. Assuming that extinction is a case of learning not to respond, we might say that where the CS has high information value this learning appears to progress more rapidly. Where the animal has learned previously that the occurrence or non-occurrence of the UCS cannot be reliably predicted from the occurrence of the CS, i.e., where the CS has low information value, there is less sensitivity to extinction.

Another line of evidence we wish to pursue now stems from the controversy in discrimination learning as to whether the learning is continuous or non-continuous. By continuous learning it is implied

３. This assumes a certain relationship between objective probability as determined by the observer and subjective probability as held by the responding organism. We attempt to handle this relationship in the discussion of our transmission model in Chapter Three.
that the discrimination comes about through the gradual build-up of excitatory potential for the positive stimulus and inhibitory potential for the negative stimulus (34). The non-continuity position holds that the discrimination results from the animal's trying one set of discrimination dimensions after another until he finds the correct one (17, 18). According to this latter view the reinforcement serves to confirm or deny the correctness of the animal's choice of dimensions.

One of the experimental arrangements by which it was hoped to get crucial evidence for one interpretation or the other, was where the animal received a set of pretraining trials in which the positive and negative stimuli were reversed. If learning is continuous this should lead to greater interference in the later problem than if it is discontinuous. The evidence and theoretical issues in this controversy have been presented by Blum and Blum (6). They conclude that "Under conditions of massed trials, punishment, and difficult discriminations, the effect on subsequent learning of the reversed problem in terms of trials and errors will apparently support the non-continuity theory; with spaced trials, no punishment, and easy problems, the results will be seemingly confirmatory of the view that the learning process is continuous."

Note that one of the variables upon which the outcomes of experiments appear to vary is the difficulty of the discrimination involved. From an information viewpoint we might conclude that discriminations become more difficult the larger the number of equally probable alternatives. Thus, the discrimination problem is one of deciding which of these alternatives is the correct one. The information as to the correct alternative is transmitted by the occurrence or non-occurrence of the
reinforcement. Therefore, in the difficult problem we would conclude that each reinforcement, by virtue of its indicating the correct alternative from a larger number of alternatives, has a higher information value than does the reinforcement in an easy discrimination problem.

Again let us view this as a deutero learning situation where the animal not only learns which is the correct stimulus, but also learns something about the information value of the reinforcement. We might conclude that the animal learns during the pretraining period, not only which stimulus is correct at that time, but also how much information the reinforcement is worth. If we assume for the moment that an organism will base its responses on those elements in its environment which convey the most information to him, then we would expect that with increased difficulty of the problem and hence increased information value of the reinforcement, changes in the reinforcement, e.g., from occurrence to non-occurrence, would lead to sharper changes in behavior and consequently lend support to the non-continuity point of view.

This type of analysis shifts the emphasis in learning from the development of specific associations to learning that the reinforcement is a reliable guide to the correct solution of the problem. It should be pointed out that such an analysis would also be in harmony with Harlow's work on learning sets (12) where it appears that the animals are learning to learn. We would claim that they are probably learning that reinforcements have a certain amount of information value and can serve as reliable bases for action.

From the literature thus far reviewed there seems to be some
justification for our assuming that changes in conditions involving high information value elements result in greater changes in related behavior than do changes involving low information value elements. But thus far we have been dealing with situations involving what we might term high invalidation. Where the unconditioned stimulus had followed fairly regularly upon the presentation of the conditioned stimulus, it suddenly ceased to so so; where one stimulus was positive and another negative, this was suddenly reversed. The question now arises as to the relationship between low invalidation and information value.

Studies of Intolerance of Ambiguity and Cognitive Rigidity

Most studies of human characteristics agree in finding that where these characteristics can be ordered to a continuum, a given sample of individuals will distribute themselves over the entire range of the continuum in something approaching a normal distribution. Similarly, if one were to take a large sample of responses from one individual over a period of time and order these to a given continuum such as generosity vs. niggardliness, it is reasonable to expect that we would again find these responses presenting something of a normal, although perhaps somewhat skewed, distribution over the continuum.

Assuming that the problem posed for one person in dealing with another person is that of predicting his reaction in any given situation, this reduces to deciding where on the continuum either the individual or the bulk of his responses fall and making predictions from this. If all of the possible positions on the continuum are
construed as alternatives, then we have a situation where we seem justified in concluding that the person who is able to reduce the number of alternatives to, let us say, two, has more information than the person who can only reduce them to three. Note that there is no presumption as to the accuracy of the information. Information is being used in its narrowly defined sense of negative entropy or order. Hence the person who can bring greater order to his social environment might be considered to be using high information value constructs.

This now permits us to consider the work done on intolerance of ambiguity, rigidity, and authoritarianism. Although this is an area of research itself marked by ambiguity, Frenkel-Brunswik and her associates (2) have observed that there is a high correlation between intolerance of ambiguity, rigidity, and authoritarianism. How does this relate to our study?

Intolerance of ambiguity, as defined by Frenkel-Brunswik (2, 10), involves an either-or approach to situations. The person tends to dichotomize situations and persons and ignores the various nuances between these extremes. Thus he sees people as either good or bad, honest or dishonest, etc.; he can't accept ambivalent feelings in himself or understand them in others. As contrasted to the person who does not dichotomize, we might say that, whatever the basis upon which the one dichotomises, it contains more information for him than does the basis used by the person who does not dichotomize. As far as the intolerant person is concerned, his prediction problem is far simpler than is that of the tolerant person. Accepting information as equivalent to amount of order in a situation, it is then reasonable to expect that the person
who habitually seeks greater order in his life should be the one who
prefers institutions and persons which tend to preserve or promote
this order, viz., should be higher in any measure of authoritarianism.

But now for the relationship between intolerance of ambiguity and
rigidity. It is characteristic of most rigidity studies (21, 29) that
after the person has learned one solution to a problem, the arrange­
ments change so that this is no longer the most appropriate solution.
However, in most studies, the first solution can still be utilised with
some degree of success. The measure of rigidity is the measure of the
tendency of the person to persist with the same solution in spite of
the changed conditions. The nature of these studies is fairly general
although the results and interpretation are far from univocal. It is
not our intent to enter into this controversy, but rather to use the
phenomena as a paradigm for the effect of low invalidation on a con­
struct (e.g., the basis of the solution to a problem) having high
information value as contrasted with one having low information value.

We construe these experiments as involving low invalidation since,
by way of contrast with the earlier extinction and discrimination
studies mentioned, the alteration of conditions making the original
solution no longer the most appropriate is not such as to make it un­
tenable. Accepting the person who is markedly intolerant of ambiguity
as more likely to enter any problem-solving situation with high infor­
mation value concepts than a person not markedly intolerant of ambiguity,
the conclusion seems justified that high information concepts are less
likely to change under conditions of low invalidation than are low infor­
mation concepts. It takes major changes in the environment of the person employing high information value concepts before there are changes in his behavior; once these changes occur they are likely to be greater than for the person utilizing low information value concepts.

In our review of the literature thus far we have been rather cavalier in our drawing inferences based on studies involving subjects ranging from the rat to man. We are not unmindful of the pitfalls involved in such an enterprise but feel that in an area of study as relatively uncharted as this we are justified in proceeding with less caution and more freedom. In the following section we return to more familiar territory; studies in Personal Construct Theory.

Studies in Personal Construct Theory

If Kelly's major assumption is correct, that each individual seeks to anticipate accurately events in the world about him, and if these anticipations or predictions are based on the individual's construction of his world, the question arises as to what happens when his predictions are not validated. If the individual is attempting to improve his predictions, then there are two possibilities from the point of view of Personal Construct Theory; he can change his predictions leaving his construction of his world intact or he can change his construction of his world somewhat and make new predictions based on the changed construction. If, however, predictions are actually based on the individual's construction of any situation, then we should expect that with invalidation there would be changes in construction at least as often as there would be changes in predictions.

Poch attempted to test this expectation (28). After administering the RCRT to a group of subjects, she had each of them make predictions
about the behavior of two other classmates and specify which of his constructs he used in making his predictions. Subjects were then told that they did poorly on their predictions on one of the persons and well on the other. Three weeks after this first prediction series each subject was put through the same procedure and asked to make predictions about the same two people again and indicate which of his constructs he used in making his predictions.

Poch found that there was a greater tendency among the subjects to change the constructs used in making their predictions on the classmate where they had received invalidation of their predictions than where they had received validation. This is consistent with our expectations as to the effect of invalidation on constructs employed, but leaves certain questions unanswered.

One unanswered question is that of what happened to the subject's construction of the invalidated figure on the construct used in the first session but not in the second? Are we to assume that this construct is no longer used in construing this figure because another construct has been selected on the second occasion? Such an assumption would presuppose that constructs are in themselves extremely erratic and would not suggest that they could provide the individual with much stability in his day-to-day contact with reality. We would be inclined to view this finding as something of an artifact resulting from the subject having had the freedom to invoke the construct a second time or not as he chose. If constructs are at all enduring in nature then the most reasonable expectation appears to be that the subject shifted the person
he was construing from one end of the dimension to the other. This could have been investigated if the subjects were required to use the same constructs on the second occasion and indicate the predictee's position on them. This procedure is utilized in the present study.

Since Poch's study was done before there was any means of categorizing the constructs elicited and since the actual nature of the constructs elicited was not of major concern to her, we can make no inferences as to the information value of the constructs elicited or of their susceptibility to change as a function of their information value.

Attempting to determine whether one could predict generalization of changes along a dimension of similarity from one construct to another, Bieri (5) utilized a design similar to Poch's. He had his subjects make predictions about classmates and also indicate which constructs they were utilizing in making their predictions. Then he told them that on one set of predictions they were inaccurate while on the other that they were accurate. He then had them fill out the matrix again using the same constructs as before but with freedom to reconstruct the figures on them. He found, as expected, that the construction of classmates on whom invalidation occurred and the construct specifically chosen as the basis for the subject's predictions about his classmate changed more than where there was validation of predictions. By means of the matrix method (to be described below) Bieri could ascertain the amount of similarity between constructs and found that changes on the invalidated construct showed a fairly typical generalization curve to other constructs related
to it along a dimension of similarity.

The major import of Bieri's findings for the present study is that measures of relationship between constructs appear to be meaningful since they permit predictions of generalization of changes. His data were not analyzed so as to indicate which constructs explained the greatest part of the total variance (most constellationary) and hence do not permit inferences as to what we might find if we contrast invalidation of constellationary constructs with invalidation of propositional constructs. It does suggest that the measure of similarity between constructs might provide a reliable criterion for constellationarity or propositionality.

Following a factor analysis of four individual RCRT protocols by Levy and Dugan (19) in which it was demonstrated that a construct repertoire of fifteen constructs could be meaningfully explained by as few as four orthogonal factors, Kelly (15) developed a non-parametric equivalent to factor analysis which permits the factoring of an RCRT protocol by one person in something under an hour and a half. Whereas Levy and Dugan had their subjects rate each person named under their role titles on a five point scale as to whether the construct or its contrast applied, Kelly had them use either a check or zero depending upon whether the construct or its opposite applied. Such an approach was actually more in keeping with his assumptions concerning the dichotomous nature of constructs as well as analogous to the manner in which modern communications and computing devices operate.

By Kelly's procedure, factor loadings are obtained by means of scanning patterns made up of checks and zeros. The higher the number
of matches between the scanning pattern and the pattern generated by any given construct as it is applied to the people listed under the individual's role titles, the higher the loading of that construct on that factor. By means of the binomial expansion it is possible to establish confidence limits for these loadings and determine what one will accept as a significant loading. A factor loading which is such that the number of matches leading to it would occur by chance ten or less times in one hundred is accepted by Kelly as significant.

This procedure usually results in from two to seven factors for a protocol. Thus we are provided with an operational criterion for determining whether a given construct is constellatory or propositional. Since this determination hinges on the extent to which the construct is correlated with other constructs in the repertoire, and assuming that all constructs loaded on a given factor will be more highly correlated with each other than they will be with any other constructs, it follows that those constructs having significant loadings on the most general factor will tend to be more constellatory than those constructs not loaded significantly on that factor. Returning to our earlier discussion of the effect of correlation on information value, it follows that we should expect that any one constellatory construct should have greater information value than any one propositional construct, but that any given group of constellatory constructs should have less information value than any given group of propositional constructs. The theory to be presented in the next chapter takes this as one of its theorems.
Summary

In this review of the literature we have attempted to sample various areas of psychological research in an attempt to find support for our study. After a brief exposition of information theory and the way in which we interpret it, we reviewed studies dealing with experimental extinction, discrimination learning, intolerance of ambiguity, rigidity, and Personal Construct Theory. In each of these areas we have made inferences which we believe lends some amount of credibility to the theory we are proposing. In the next chapter we shall present a formal version of our theory with the hypotheses to be tested.
Chapter Three

A Formal Theory Concerning the Relative Information Value of Personal Constructs

The future historian of science will undoubtedly be interested in the present tendency in certain psychological circles to spin out theories and systems ad infinitum. Whether this represents a retreat to a phantasy level, a swing to the right politically, a bid for re-recognition and status, or a disguised compulsion neurosis, we cannot determine from our perspective in time. But, feeling some need to justify the following attempt, we present what we believe to be three advantages of such a venture: (1) An attempt at formalizing the basis on which one builds his hypotheses should disclose inconsistencies in assumptions and logic; (2) such disclosures should point up the weak points in our knowledge or interpretation of phenomena; and, (3) the weak points disclosed along with the hypotheses deduced from the theory should serve to stimulate further research.

We shall follow the general hypothetico-deductive form starting first with a definition of terms, then postulates, and finally hypotheses. Following this we shall present a schematic representation of the transmission model which we believe to be implicit in this system. The experimental predictions will be presented following a description of the methodology in Chapter Four.
Definitions

1. **Information.** Information is taken as equivalent to order or lack of randomness in a given situation. The information value of an event is equal to the logarithm to the base 2 of the number of equally probable alternative events including that event. In this definition each event is construed as either occurring or not occurring, and the occurrence of one event implies the non-occurrence of all other events.

   It should be pointed out that this definition must be considered an idealized definition since we are not yet in the position of being able to specify accurately the "number of equally probable" alternatives. It does permit us, however, to talk about "more" or "less" information value.

2. **Redundancy.** Redundancy is the amount of information conveyed by an event which does not increase the already existing amount of information present. Where two elements are perfectly correlated, and the one element is determined as present or not present, the observation of the presence or absence of the second element does not constitute information, but redundancy. The redundancy of an event might be measured by the accuracy with which its occurrence can be predicted from the occurrence of other events. In this sense no element is in and of itself redundant, and in fact, whether an event is to be considered as information or redundancy depends solely on its temporal order of occurrence with other correlated events. Where an event comes first in a correlated temporal sequence it constitutes information; where it comes last, it constitutes redundancy.
3. **Construct.** A construct is a means of coding information or experience. It is considered dichotomous in nature and represents the means by which an individual determines how two things are alike and at the same time different from one or more other things. The one end of the construct denotes the similarity between the things subsumed, while the other end denotes the opposite of this or the difference between the similar events and other events not seen as similar to them.

Constructs need not be verbalized but they may be symbolized by words as when a person fills out an RCRT.

A **construct repertoire** is a representative sample of the constructs used by an individual.

**Construction** refers to the process of placing persons or events at various positions on the construct dimensions of the individual's construct repertoire. An individual's construction of an event or person may be inferred either from his overt behavior, or from his description of the person or event in question.

4. **Constellatoriness-propositionality.** These terms represent two ends of the same dimension, namely the tendency for the construction of an event on one construct to affect its construction on other constructs. The greater the tendency noted for this to occur for any construct, the greater the constellatoriness of that construct. In practice this may be determined by the amount of correlation between one construct and other constructs; the higher the correlation, the greater the tendency for construction on that construct to affect construction on other constructs, and hence, the greater its constella-
toriness. Of two constructs, that construct having the higher correlation with all other constructs will be labelled constellatory (Co), that construct having the smaller correlation will be labelled propositional (Pr).

Postulates

I. Where there are two systems A and B, and where the elements of system A have a higher intercorrelation between them than do the elements of system B, the occurrence of any one element in system A when taken alone, has higher information value than does the occurrence of any one element of system B. The sum total of information will be higher for system B than for system A. This postulate stems directly from our definitions of information and redundancy. Since the one element in system A predicts more of the rest of the elements by virtue of the higher intercorrelation than does the single element of system B, its information value is higher. However, because the majority of the elements in system A can be predicted better than in system B, redundancy is higher in system A and so the sum total of information value will be lower.

II. Where changes are brought about in the elements of a system, the size of changes in behavior dependent upon those elements will be an increasing monotonic function of the sum total of the information value of those elements.

If we think of a situation where behaviors are dependent upon a set of elements in a system such as a construct repertoire, then this would follow from our definition of information value. Thus if a
person construed an individual as both honest and sedate, and if the element honesty had higher information value than did sedate, we would expect that if he were given sufficient information so that he changed his opinion of the person's honesty, there would be a greater change in his reaction toward that person than if he changed his opinion as to the person's sedateness.

III. The amount of contradictory information required to bring about change of construction on a set of constructs is an increasing monotonic function of their respective information values.

Again this would follow from our definition of information value in the following manner: Let A be a construct with an information value of three bits and B a construct with an information value of two bits. This can be interpreted as construct A giving information about construction on a total of eight constructs including itself, whereas construct B gives information on a total of four constructs. For the person involved in construing, this could be construed as giving eight reasons why he is right on construct A and only four reasons why he is right on construct B. Thus we would expect to have to supply more information or more forceful information to bring about reconstruction on construct A than on construct B.

IV. Individuals are able to assess the relative information value of their constructs.

This makes use of the concept of deutero learning discussed in the preceding chapter. Whenever a student says that one instructor really knows his stuff while another is just so-so, he is probably demonstrating the operation of deutero learning. He has not only learned the sub-
ject matter in the two courses but has also learned something of the value of the two instructors as sources of information in their respective subjects. We do not mean to imply by this example that the evaluation of the instructors is necessarily accurate nor do we mean to imply that deutero learning only applies to assessment of information value. As Bateson points out (4), deutero learning is probably responsible for a good many of our attitudes and expectancies.

Hypotheses

In presenting our hypotheses we will indicate in parentheses following each hypothesis, the postulates and definitions from which it is derived, for example, (2, I) would mean definition two and postulate one.

A. Where individuals are asked to compare constellatory and propositional, (Co) and (Pr), constructs on the basis of their information value, Co constructs will receive a higher rating than will Pr constructs. (1, 3, 4, I, IV).

B. Changes in construction on Co constructs will lead to greater changes in related behavior than will changes in Pr constructs (3, I, II).

C. Where reconstruction is brought about on an equal number of Co and Pr constructs and where this number exceeds one, changes in construct related behavior will be greater for changes on Pr constructs than on the Co constructs (1, 3, 4, I, II).

D. Where conditions are such as to indicate that major changes in construct related behavior are required (high invalidation), there will be a greater change in constructions on all constructs than where
minor changes are required (low invalidation) (I, 3, I, II, III, IV).

E. Under conditions of high invalidation of construct related behavior, there will be a greater number of reconstructions on Co constructs than on Pr constructs. Under conditions of low invalidation the reverse will be true. (I, 3, 4, I, II, III, IV).

A Tentative Transmission Model

Information theory, as it is usually presented, appears to be predicated upon a transmission model by means of which one can characterize input-output relationships. Examples of such models may be found in (9, 11, 32). It appears then that if we are to use the concept of information in anything approximating its conventional usage, we should now commit ourselves to some type of transmission model. A tentative representation of such a model is presented in Figure One.

![Figure One: A Schematic Transmission Model](image-url)
In this model, input is represented by events. These only take meaning after they are construed by the individual in terms of his construct repertoire. Following this, certain responses are emitted; these represent the output. Thus the responses of an individual in any given situation are not a direct result of the events (or stimuli) present in the situation, but rather of his construction of those events.

In terms of information and communication, the individual becomes a communication channel transmitting messages which are fed into it in the form of environmental events and are fed out by means of certain responses.

It will be noted that we have added an evaluative system to the usual transmission model, and that we have also placed arrows going in both directions between the construct repertoire and the evaluative system and between the construct repertoire and responses. The two sets of arrows are to represent a feedback arrangement whereby the individual not only transmits messages in the form of responses, but in turn receives information as to the effects of these responses on the environment. This feedback permits us to account for two things: (a) the self-corrective nature of living organisms, and (b) the ability of the individual to assess the utility and information value of his construct repertoire.

**Evaluative system.** The function of the evaluative system in our diagram is that of monitoring the functioning of the communication channel. Where responses do not result in the effect expected of them by the individual, this is communicated to the evaluative system by
means of feedback. The arrow leading from the evaluative system to the construct repertoire indicates that the evaluative system has some control over the individual's construct repertoire, i.e., where constructions have led to false predictions as judged by the evaluative system, changes can be induced either in the nature of the construct repertoire or in the construction of the events themselves.

It should be noted that the feedback from responses does not go directly to the evaluative system, but rather through the construct repertoire and then into the evaluative system. Thus while a response may be judged patently ineffective by an observer, it may not be construed so by the individual producing it. This arrangement suggests that it is necessary to have some knowledge of the individual's construct repertoire before one can either predict his behavior or bring about changes in his behavior.

Self-correction. Within our schematic diagram, self-correction falls within the province of the evaluative system. Where Kelly has said that individuals act so as to increase the accuracy of their anticipations, and where other theorists have used the term learning, we have introduced the concept of self-correction. This is not an entirely new concept in psychology and is only introduced because it appears to be more consistent with the model we have chosen and with the concept of feedback.

The definition of learning which states that it is represented by changes in behavior as a function of experience or training serves equally well as a definition of self-correction. By using the concept of self-correction, however, we hope to convey the idea that the
organism takes a more active part in the determination of its behavior than is implied in the concept of learning. There is the further implication that the organism is goal-directed and anticipatory, and that when changes occur in its behavior it is because of certain anticipations and evaluations on the part of the organism rather than because of changes in the environmental situation.

The assessment of information value of constructs. The measure of information value which we have been using, \( I = \log_2 p \), is based on an estimate of probability in the form of the number of equally probable events or responses in any situation. Theoretically at least, the experimenter can make such an estimate through his knowledge of the experimental arrangements or his sampling of the events. But, since we are hypothesizing that the individual himself can also estimate the information value of his constructs, we are introducing a subjective estimate of probability on the part of the individual. The problem now becomes one of specifying the relationship between these two types of probability and the means by which the individual makes his probability estimates.

Let us take the latter problem first, how objective probability is translated into subjective probability. This is a difficult problem and one which has been faced by cognitively oriented theorists such as Tolman and Brunswik (7, 8, 36). The usual solution to the problem, however, is simply the statement that the organism eventually learns the probabilities in the situation or is able to discriminate between two different probabilities. Indeed, in our review of the literature we took the same approach calling it deutero learning. This is admittedly
begging the question and so we shall hazard an attempt at some further
discussion of this problem. The aim, however, will be not so much to
explicate the problem as to elaborate on it somewhat.

So-called objective probability is the result of the occurrence
of a large number of events which can be placed in a frequency dis­
tribution with respect to some dimension. The probability of any one
event occurring can be estimated by observing its position in the fre­
quency distribution. Further, when asked whether a given event will or
will not occur, or when asked for the position of an event on a con­
tinuum, one usually replies with a statement of probability of occurrence,
or with a statement of a value followed by plus or minus signs indicat­
ing a certain range of values and a statement of probability. Thus,
for example, if we were asked to predict a person's score on a given
test we would respond with the statement that it will probably be x plus
or minus y. We give the confidence with which we are willing to make
these statements by a statement of probability which is a way of stating
the amount of risk involved in accepting the score given as correct.

The more information one has about the determinants of an event
the less the likelihood of error in prediction and hence, the less the
risk. If one were able to make perfect predictions at all times, he
would have no need of the statistics of probability since there would
be no risk involved in accepting his predictions as true. But this is
hardly ever the case for the scientist or for any other organism. Thus
probability becomes an important accompaniment in any predictive venture
and it is for this reason that we have chosen to construe the organism
as being concerned with probability, frequencies, and correlations.
But how does objective probability, i.e., the actual frequency of occurrence, become translated into subjective probability? We propose that the organism learns of probabilities in the same fashion as the scientist does, by observation. To return to the schematic diagram, estimation of probabilities would be a function of the evaluative system whereby each construed event is compared with other similarly construed events and then located at some point in a frequency distribution of such events.

To be sure, the organism's estimate of probability may not conform in any exact fashion with the observer's estimate (7). There appear to be two reasons for this. First, the organism may be putting a different construction on some of the events which the observer is including in his estimate. This would necessarily result in different parameters for the two frequency distributions since some of the events included by the organism may not be included by the observer and vice versa.

Second, it is quite likely that the observer and the organism, irrespective of their construction of the events in question, have not had equal sampling opportunities. As is so often the case, the observer has a fairly large and representative sample of observations, perhaps including those made by others, from which he makes his estimate. In other instances the observer actually determines what the probabilities shall be. The organism, on the other hand, is limited to only his own observations which in many instances are too circumscribed to yield accurate probability estimates. Nevertheless, we are hypothesizing that there will be a sufficient relationship between
these two types of probability so that inferences of an approximate nature can be made regarding the organism's subjective probabilities.

When we make statements as to the information value of certain constructs, we are in effect assuming a close approximation between the individual's estimate of the number of equally probable constructions involved and our own estimate. Whereas the individual's estimate is based on his own observations of the workings of his construct repertoire over a period of time, we make our estimate from the way in which he fills out an RCRT. For the individual this represents an estimate based on longitudinal sampling; for the observer, cross-sectional sampling.
Chapter Four

Research Design and Experimental Predictions

The hypotheses presented in Chapter Three constitute deductions from our postulates but are in too general a form to permit testing. They should, however, generate certain predictions in any given experimental situation which meets certain specifications.

**Design Specifications**

An experiment which could test our hypotheses should meet the following specifications: (a) There should be a sample of each individual's constructs and a means of classifying them as either Co or Pr; (b) There should be some sample of behavior which can be construed as construct related; (c) Operations should be specified by means of which high and low invalidation can be produced; (d) There should be a sample of the individual's construction of persons which can be subjected to experimental manipulation; (e) There should be some means of forcing subjects to reconstrue individuals on their Co and Pr constructs; (f) Measures of changes are required on both constructions and construct related behavior; (g) Some means should be provided for having the subject assess the relative information value of his Co and Pr constructs.

These specifications represent the hypothetical variables in our miniature system. We should now like to present their definition in terms of the experimental operations of this study. Following this we will present the procedure together with the experimental predictions.
which we believe our theoretical hypotheses would generate.

**Operational Definitions**

The distinction between Co and Pr constructs. By means of Kelly's nonparametric approach to factor analysis we extracted one general factor from each RCRT protocol. We shall define a general factor here as any factor having at least eight constructs with significant loadings on it. In practice this usually turns out to be either the first or second factor extracted. Co constructs will be those constructs having significant loadings on the general factor and Pr constructs will be all others.

Here we are assuming that the probability is greater that constructs having significant loadings on the general factor will be related to a larger number of other factors than will constructs not significantly loaded on this factor. We are further assuming that any group of Pr constructs will be less likely to be loaded all on the same factor than any group of Co constructs. Thus we would infer that Pr constructs will be more independent of each other than Co constructs in any given protocol.

Construct related behavior. The construct related behavior in which our subjects engaged was making predictions as to how two persons would respond in a variety of situations. The only information the subject had concerning these persons was their photographs. Our justification for construing this as construct related behavior stems

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4. A complete set of the materials used in this research are included in Appendix B.
Personal Construct Theory which holds that individuals base their anticipation of events on their construction of these events. Thus we should expect that given such a prediction task each subject would first attempt to construe the person whose behavior is to be predicted on his own construct dimensions and then base his predictions on his construction of the person. With regard to the transmission model which we have assumed, it will be observed that in a sense all behavior is construct related.

**Operations for producing high and low invalidation.** Subjects were told that we were interested in the accuracy with which they can make judgements about people from their appearance in photographs. This was presented as an important skill in interpersonal relations. High invalidation is defined by the experimenter informing the subject that he missed quite a few prediction items and was in fact below average as compared with others who have attempted it. Low invalidation is defined by the experimenter informing the subject that he missed some prediction items, but compared with those who have attempted the task thus far, he is above average.

**Construction of persons on Co and Pr constructs.** Because we were interested in changes in construction as both a dependent and independent variable, it was important to have the subject indicate his construction of persons on both types of constructs. For this purpose five Co constructs and five Pr constructs were selected from each protocol and presented to the subject as two-point rating scales on which he was to describe the persons whose pictures he was presented with.
The particular Co and Pr constructs used for these scales were determined in a manner which was designed to eliminate experimenter bias. The five constructs having the highest significant loadings on the general factor were chosen as the Co constructs and the five constructs having loadings closest to chance expectancy on the general factor were chosen as the Pr constructs. In cases where one or more of the first five chosen were judged unusable by the experimenter, either by virtue of their specific nature or because they were a verbatim repetition of another construct, the next construct fulfilling the criterion was selected. Examples of types of constructs which could not be used will be given in Chapter Five.

**Forced reconstruction.** In order to test the effects of reconstruction on construct related behavior, it was necessary to force subjects to reconstrue the objects of their predictions. We hoped to accomplish this by telling the subject that the end of the construct opposite to that on which he had placed the object was correct. For example, in the construct "friendly-unfriendly", if the subject construed the object of his predictions as "friendly", we would force reconstruction on this construct by indicating that "unfriendly" is more correct.

**Measures of changes.** Measures of changes on both construct related behavior and on construction were obtained by means of repeated measurements where the number of changes from one set of predictions or constructions to the next constitutes the measure of change. As will be evident from this design, this also permits the use of the
more sensitive t test for repeated measurements on the same indivi-
duals (22).

**Assessment of information value.** Subjects indicated the relative information value of Co and Pr constructs, as perceived by them, by a paired comparisons technique whereby each Co construct was paired with every other Pr construct. The subject indicated in each case which member of the pair (Co or Pr) would be of more value to him were that construct used in describing a stranger and his task was to understand that person and be able to predict his behavior. The number of pairs are $5 \times 5$, or 25, and the relative information value for each type is the sum of the times that it is chosen as having the greater predictive value.

**Procedure**

**Subjects.** Because it was believed that motivation might play a large part in the subject's performance in this experiment, it was decided that volunteer subjects might be more appropriate than those who must take part in experiments as one of their course requirements. For this reason subjects were recruited from two Psychology 404 (Educational Psychology for Medical Personnel) sections and two Psychology 407 (Educational Psychology) sections. A total of 40 subjects were used in the study although we began with 80. Of the 80 prospective subjects, 25 produced RCRT protocols which were judged unuseable and 15 failed to keep their appointments. Although this rate of attrition might appear high, it did not seem too high a price to pay for the cooperation which was received from the 40 experimental subjects. Of the 40 subjects used, 33 were females and 7 were males. Since our hypoth-
ases and theory gave no reason to expect sex differences, no attempt was made to control for sex of subject although in actuality the two sexes were approximately proportionally distributed over the various conditions of the experiment.

Administration of RCRT. The RCRT was administered on a group basis during one of the class periods of each of the sections involved. Prior to the date of administration the experimenter appeared before the class for about ten minutes explaining briefly that their cooperation was being solicited for a research project concerned with "finding out how we think about other people." At this time the list of role titles was distributed and members of the class were asked to have them filled out for the next class period. The classes were told that if they did not wish to participate in the experiment they need not sign up for the individual sessions.

Approximately two-thirds of each section failed to complete the RCRT during the allotted class period and finished it at home. While Shoemaker (33) believed that different constructs might be obtained where subjects had more time to work on them, we were left with no choice in the matter since we could not use another class period.

Each RCRT protocol was factored to the point where one factor containing at least eight significantly loaded constructs on it appeared. From this, five Co and five Pr constructs were derived according to previously defined criteria. These were typed up so that the construct and its contrast represented two alternatives or two points on a rating scale. With the exception of the first two,
the order in which Pr and Co constructs appeared was determined from a table of random numbers. Because of the design, it was necessary that the first two constructs be one of each type. The actual order was: Co, Pr, Co, Co, Co, Pr, Pr, Pr, Co, Pr.

**Individual sessions.** In designing the individual session, it was attempted insofar as possible to use the individual as his own control. This could only be accomplished up to a point, beyond which it was necessary to break the subjects down into two experimental groups. The basis for this breakdown was the number of constructs on which the subject was forced to reconstrue the two persons used in predictions. Group I was forced to reconstrue each person on one construct while Group II was forced to reconstrue each person on four constructs.

The procedure was as follows: **Part I.** All subjects were presented with photographs of two persons, A and B. Students were told that we were interested in the accuracy with which they could judge personality from photographs. They were told that this was a skill which we all possessed to some degree and that in this experiment we were interested in seeing how well they could utilize this skill and improve their predictions about each person as they were given additional information about him.

Subjects were then told that we would be interested in how they described each person in their own terms (their constructs) and how accurately they could answer fifteen questions about each person's behavior. We will refer to these operations as R₁ (first set of constructions) and P₁ (first set of predictions). When subjects had done
as the subject finished each set of constructions and predic-
tions, the experimenter went through the motions of scoring these by
comparing them with some "data" which he presumably had on the person
being studied by the subject.

**Part II.** Subjects were told that on the first trial we only
scored their predictions for each of the persons and that the first
time around the only information we could give them was how accurate
these were. We could not tell them which of the items they missed or
exactly how many.

Predictions on one of the persons were then given high invalida-
dation and predictions on the other person low invalidation. For ease
of exposition we will refer to the person on which high invalidation
occurred as person A and the person on which low invalidation occurred
as person B. In practice, invalidation on the first person and second
person was alternated from subject to subject to control for any se-
quential effects which might exist. Similarly, the actual photographs
were regularly alternated so that each person appeared as first and
second just as often.

Subjects were then asked to go through the operations of making
descriptions and predictions for both persons a second time. They
were told in each case that we wanted to see how much they could in-
crease their accuracy before being given any more specific information.
In making their predictions and descriptions for the second time, they
could refer to their first set of predictions and descriptions. This
was permitted so as to reduce whatever unreliability might be intro-
duced due to individual differences in recall. This then yielded,

\( R_{2A}^*, R_{2B}^*, P_{2A}^*, \) and \( P_{2B}^* \).

From our hypotheses we would make the following predictions at this point:

1. \( (R_{1A}^* - R_{2A}^*) > (R_{1B}^* - R_{2B}^*) \) (C)
2. \( (CoR_{1A} - CoR_{2A}^*) > (PrR_{1A} - PrR_{2A}^*) \) (D)
3. \( (CoR_{1B} - CoR_{2B}^*) < (PrR_{1B} - PrR_{2B}^*) \) (D)
4. \( [(CoR_{1A} - CoR_{2A}^*) - (CoR_{1B} - CoR_{2B}^*)] > [(PrR_{1A} - PrR_{2A}^*) - (PrR_{1B} - PrR_{2B}^*)] \) (D)
5. \( (P_{1A} - P_{2A}^*) > (P_{1B} - P_{2B}^*) \) (B, D)

The letters in parentheses refer to the theoretical hypotheses involved in the particular prediction. The first prediction would read: Changes in construction will be greater following high invalidation than following low invalidation. The second prediction would read: following high invalidation, changes in Co constructs will be greater than changes on Pr constructs. The rest of the predictions may be read similarly.

Again, as the subject finished each set of constructions and predictions, the examiner went through the operations of scoring them. This time, however, reconstruction of each of the persons was forced by the experimenter on either one or four Co and Pr constructs.

Part III. When the subject received his scored answer sheet after his second set of predictions and constructions, he was told by the experimenter that this time he would be given more specific information about each of the persons he was working on. At this point the subjects were divided into two groups.

Group I subjects were told that we were only scoring their first
two descriptions. Then on one of the persons the subject was told that his Co construct was incorrect and that the opposite applied, while on the other person the subject was told that his Pr construct was incorrect and that its opposite applied. This constituted the forced reconstruction of each of the persons. In order to control for the previous experience of either validation or invalidation of predictions on a particular person, the order of reconstruction on Co and Pr constructs was counterbalanced so that over the total number of subjects reconstruction on a Co or Pr construct was forced on person A just as often as on person B.

Group II subjects were given to understand that we were now scoring all of their descriptions. Then a procedure parallel to that for Group I was used except that reconstruction was forced on either four Co constructs or four Pr constructs. In forcing reconstruction, the particular constructs on which reconstruction was to be forced was determined beforehand and without reference to the particular constructs used by any subject. Where reconstruction was forced on Co constructs, this occurred on constructs numbered 1, 4, 5, and 9. Where reconstruction was forced on Pr constructs, this occurred on constructs numbered 2, 6, 7, and 10.

This procedure permitted us to test the relative effect on predictions of reconstruction on Co constructs vs. Pr constructs as well as the effect of number of constructs involved. Since the person on whom reconstruction was forced with respect to either Co or Pr constructs was alternated so as to counterbalance the effects of the
previous experience of high or low invalidation of predictions, in our notation we need not indicate which figures are involved. We shall indicate the type and number of constructs on which reconstruction was forced by a superscript. Thus \((P_2 - P_3)_{\text{4Co}}\) would be read as the difference in predictions where reconstruction had been forced on four Co constructs. With this notation we now state the following experimental predictions, indicating in parentheses the theoretical hypotheses from which they are derived:

1. \((P_2 - P_3)_{\text{1Co}} > (P_2 - P_3)_{\text{1Pr}}\) (B)

2. \((P_2 - P_3)_{\text{4Co}} < (P_2 - P_3)_{\text{4Pr}}\) (E)

3. \((P_2 - P_3)_{\text{1Pr}} < (P_2 - P_3)_{\text{4Pr}}\) (B,E)

4. \((P_2 - P_3)_{\text{10Co}} < (P_2 - P_3)_{\text{10Pr}}\) (B,E)

Part IV. Following the subjects' last set of predictions, each was asked to do a paired comparison of his five Co constructs with his five Pr Constructs. This was executed on a form in which all of the combinations were arranged in random order and the subject circled the number corresponding to the construct in each pair which he felt had more information value for him.

This permitted our final prediction:

5. \(\text{I.V.}_\text{Co} > \text{I.V.}_\text{Pr}\) (A)

Which may be read as: Co constructs will be rated as having higher information value than Pr constructs.

A methodological question. There are two methodological questions which should be considered and which we believe are related. The first concerns the method by which we derive our Co and Pr constructs. It
might be phrased as follows: If these Co and Pr constructs are so
different, shouldn't they be recognizable by competent judges so that
a factorial approach in deriving them is unnecessary?

The second question involves the relationship which we predict
to exist between changes in construction on Co and Pr constructs and
changes in construct related behavior. It will be remembered that the
construct related behavior involved the making of 15 predictions. The
question is whether or not the relationship between changes on either
type of construct and changes in predictions might not be due to a
bias in the selection of items favoring one type of construct or the
other. If, for example, Co constructs dealt mainly with certain areas
of behavior while Pr constructs dealt with other areas and if most of
our questions favored the area of behavior covered by Co constructs,
we should expect that upon changes in construction on Co constructs we
would get larger changes in predictions than upon changes in construc­
tion on Pr constructs.

Both of these questions seem based on the assumption that constel­
latoriness and propositionality are inherent qualities in constructs
such that one might state that there exists a class of Co and a class
of Pr constructs independent of the persons who use them. This is
counter to our theory which states that these properties are not in­
erent in the construct but rather the result of each individual's use
of the construct and the structure of his construct repertoire. Never­
theless these questions do demand some empirical answer. We have
attempted to answer them in two ways.
The first answer comes in the form of two of our experimental predictions, viz., \((P_2-P_3)^{1Co} > (P_2-P_3)^{1Pr}\) and \((P_2-P_3)^{4Co} < (P_2-P_3)^{4Pr}\).

If these two predictions hold up then the contention of bias in selection of prediction items becomes somewhat untenable since it would mean that the effect of any bias must reverse itself at some point as the number of constructs involved increases.

Our second answer, specifically aimed at the first question raised, comes from data we obtained where six graduate students thoroughly conversant with Personal Construct Theory and the definitions which we have given of Pr and Co constructs, were asked to indicate which of a sample of 20 Co and 20 Pr constructs belonged to those two categories. It was observed that their judgements were at chance level. Providing that our experimental predictions hold up, this finding argues strongly for the meaningfulness of Kelly's factorial method of treating RCRT protocols, at least so far as the extraction of general factors is concerned.

Summary

Our research design has been set up so that on all except one variable, number of constructs involved in reconstruction, subjects function as their own control. Reconstruction on constructs is both a dependent and independent variable in that we are interested in both the effects of invalidation of construct related behavior on construction, and in the effects of reconstruction on construct related behavior. Ten experimental predictions were made on the basis of previously stated theoretical hypotheses.
Chapter Five

Results

Unusable Protocols

One of the interesting side results of this research was the large number of subjects who produced protocols which were not usable for our purposes. Of the total of 80 potential subjects, 25 produced unusable protocols. Protocols were judged unusable by two criteria: (a) The constructs used had to be permeable enough so that they could be applied to a person not listed among the original role titles, or to people in general; (b) The general factor could not contain more than 17 constructs since this would then not leave the five Pr constructs necessary for our rating scales.

By far the largest percentage of unusable protocols failed to meet our first criterion; the constructs used were too impermeable to permit them being used in the construction of persons other than those on which they were originally formed. Examples of such constructs are the following: parents—not parents; in newspaper work—not in newspaper work; have faith in me—don't have faith in me; etc. There were some protocols where the constructs used were too permeable and couldn't be used for prediction purposes except in the broadest terms. These included male-female constructs and student-nonstudent constructs. In no case did the student seem unable to follow the directions for completing the RCRT, but in many instances he confessed complete inability to produce more permeable constructs.
Tests of Predictions

In Chapter Four we made a total of ten experimental predictions. Table One contains these predictions with the differences and their significance levels indicated. The differences are presented so that differences in the predicted direction are positive and differences in the unpredicted direction are negative. Significance levels are based on a two-tailed t test although we did predict the direction of the difference in each case.

For clarity's sake we will now present the verbal formulation of each of our experimental predictions along with the results.

1. Over-all changes in construction will be greater following high invalidation of predictions than following low invalidation of predictions. This prediction was supported at the .001 level of confidence.

2. Following high invalidation reconstruction will be greater on constellatory constructs than on propositional constructs. Supported at the .01 level of confidence.

3. Following low invalidation, reconstruction will be greater on propositional constructs than on constellatory constructs. Difference was in predicted direction but failed to reach significance at the .10 level of confidence.

4. Differences between amounts of reconstruction following high and low invalidation will be greater on constellatory constructs than on propositional constructs. Supported at the .05 level of confidence.

5. Raw data will be found in Appendix A.
Table One

Tests of Experimental Predictions

<table>
<thead>
<tr>
<th>Predictions</th>
<th>Mean difference</th>
<th>Standard error of difference</th>
<th>t</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ((R_{1A} - R_{2A}) &gt; (R_{1B} - R_{2B}))</td>
<td>1.775</td>
<td>.216</td>
<td>7.215</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>2. ((CoR_{1A} - CoR_{2A}) &gt; (PrR_{1A} - PrR_{2A}))</td>
<td>.35</td>
<td>.125</td>
<td>2.800</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>3. ((CoR_{1B} - CoR_{2B}) &lt; (PrR_{1B} - PrR_{2B}))</td>
<td>.125</td>
<td>.145</td>
<td>.862</td>
<td>&gt; .10</td>
</tr>
<tr>
<td>4. ([CoR_{1A} - CoR_{2A}] - (CoR_{1B} - CoR_{2B})) &gt; ([PrR_{1A} - PrR_{2A}] - (PrR_{1B} - PrR_{2B}))</td>
<td>.475</td>
<td>.199</td>
<td>2.387</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>5. ((P_{1A} - P_{2A}) &gt; (P_{1B} - P_{2B}))</td>
<td>4.075</td>
<td>.392</td>
<td>10.395</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>6. ((P_{2} - P_{3})^{1Co} &gt; (P_{2} - P_{3})^{1Pr})</td>
<td>1.05</td>
<td>.507</td>
<td>2.071</td>
<td>.05 &lt; p &lt; .10</td>
</tr>
<tr>
<td>7. ((P_{2} - P_{3})^{1Co} &lt; (P_{2} - P_{3})^{1Pr})</td>
<td>.50</td>
<td>.415</td>
<td>1.205</td>
<td>&gt; .10</td>
</tr>
<tr>
<td>8. ((P_{2} - P_{3})^{1Pr} &lt; (P_{2} - P_{3})^{1Co})</td>
<td>1.25</td>
<td>.569</td>
<td>2.197</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>9. ((P_{2} - P_{3})^{1Co} \leq (P_{2} - P_{3})^{1Co})</td>
<td>-.30</td>
<td>.692</td>
<td>-.434</td>
<td>&gt; .10*</td>
</tr>
<tr>
<td>10. I.V. Co &gt; I.V. Pr</td>
<td>4.40</td>
<td>.950</td>
<td>4.632</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

*Since no difference was part of this prediction, failure to reach statistical significance may be taken as support for the prediction.*
5. Predictions subjected to high invalidation will show greater change than predictions subjected to low invalidation. Supported at the .001 level of confidence.

6. Differences in predictions will be greater following reconstruction on one constellatory construct than following reconstruction on one propositional construct. Supported only at between the .10 and .05 levels of confidence.

7. Differences in predictions following reconstruction on four constellatory constructs will be less than following reconstruction on four propositional constructs. This difference, while in the predicted direction, failed to reach significance at the .10 level of confidence and so must be considered unconfirmed.

8. Differences in predictions following reconstruction on one propositional construct will be less than following reconstruction on four propositional constructs. Supported at the .05 level of confidence.

9. Differences in prediction following reconstruction on one constellatory construct will be less than or equal to differences following reconstruction on four constellatory constructs. This was supported insofar as the difference, which was not in the predicted direction, failed to reach significance at the .10 level of confidence.

10. Subjects will perceive and rate their constellatory constructs as having more information value than their propositional constructs. Supported at the .001 level of confidence.

In order to obtain some indication of the relative effects on changes in predictions of reconstruction on Co and Pr constructs, in
Figure Two: Mean frequency of changes in predictions plotted against mean number of changes in construction for Co and Pr Constructs.
Figure Two we present the mean frequency in changes in predictions from the first to the second set of predictions regardless of high or low invalidation. Although these two distributions do not differ significantly from each other, they do lend some admittedly tenuous support to our interpretation of the relative amounts of information and redundancy present in given numbers of Co and Pr constructs. From these curves it appears that up through about three constructs Co constructs are equal to, or greater than, Pr constructs in total information value. Beyond three constructs, however, redundancy increases at a proportionately greater rate for Co constructs than for Pr constructs. Hence the reversal of the relationship at this point between number of changes in constructs and mean frequency of changes in predictions. This trend could be checked if a larger number of constructs of each type were provided the subject so that he was not limited to five of each type.

A Test of the Consistency of Constructions on Pr and Co Constructs

By our definition of Co constructs we would expect a higher amount of consistency of construction of any given individual or event on them than we would on Pr constructs. If an individual is placed on the positive end on one Co construct, the likelihood is greater that he will also be placed at the positive end of another Co construct than is the likelihood of agreement on placement on two Pr constructs. While our extraction of Co and Pr constructs is based on their inferred correlation with other constructs, reliability of this index is open to question unless we can show that these correlations would obtain on a new sample of persons.
Although the present study was not designed to test this consistency, because our subjects were construing two new persons with a sample of their Co and Pr constructs, we were able to get some tentative estimation of their consistency in construing these two persons on both types of constructs. In order to test this relative consistency, we computed the expected frequency of occurrence of each possible number of agreements in construction on five constructs. Since we are dealing with five dichotomous variables in each case, the number of agreements on either type of construct can never be less than three nor more than five, e.g., a person may be construed at the positive end of two Co constructs and hence at the negative end of the remaining three, or he may be construed at the negative end of one Co construct and hence would be construed at the positive end of the remaining four constructs, etc.

If construction on one type of construct is more consistent than construction on another type, there should be a greater number of instances where there are agreements on either four or five constructions than would be expected by chance. Table Two presents the actual number of cases obtaining for each possible number of agreements and compares these frequencies by means of Chi Square with the expected number. These tabulations are based on the first set of constructions made on each of the two persons before the subject was subjected to any experience of high or low invalidation. For this reason the number of cases for each type of construct adds up to 80 instead of 40.

Estimates of probability are based on agreements regardless of
Tabulation of agreements took negative loadings into consideration so that placement of a person at one end of the negatively loaded construct was considered as consistent with placement of the same person at the contrasting end of a positively loaded construct. This could only be done for Co constructs since we did not know whether the loadings of the Pr constructs would be negative or positive on their respective factors. For this reason, the results of this table can only be accepted at a highly tentative level.

Table Two

A Comparison of Amount of Consistency in Constructions of Each of the Two Persons Being Construed on Co and Pr Constructs

<table>
<thead>
<tr>
<th>Number of agreements (consistency)</th>
<th>Probability of occurrence</th>
<th>Actual occurrence Co constructs</th>
<th>Actual occurrence Pr constructs</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>.06</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>.31</td>
<td>23</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>.62</td>
<td>35</td>
<td>43</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 62.6 \quad 3.05 \]

\[ p < .001 \quad .20 \]

Although there are certainly some negative instances in the results of this tabulation, the overall evaluation lends support to our interpretation of the correlational properties of Co and Pr constructs at a highly statistically significant level of confidence. On a post hoc basis, we would be inclined to attribute a certain amount of the
inconsistency which appears in this table as due to the inaccuracy of our instrument. However, remembering that judges could not agree with our classification of constructs as either Co or Pr at a better than chance level, we must conclude that the instrument, despite its inaccuracy, is a highly useful one insofar as one is interested in this type of analysis of construct repertoires.
Discussion of Results and Implications

In order to evaluate our results, let us return to our initial objectives and see how these have been met. We proposed to investigate the relationship between constellatory and propositional constructs, defined by a specified operational criterion, and relative information value. In order to do this we set up three general propositions in which relative information value functioned as an intervening variable. These were:

1. Differential amounts of reconstruction will occur on constellatory and propositional constructs following differential degrees of invalidation of construct related behavior.

2. Reconstruction on constellatory constructs leads to more extensive changes in related behaviors than does reconstruction on propositional constructs.

3. Individuals will perceive their constellatory constructs as having higher information value for them than their propositional constructs.

A miniature system was then constructed and ten experimental predictions were made. These predictions and their outcomes may now be checked against our objectives.

Predictions numbered one through four were designed to test our first proposition. Of these, one was supported at the .001 level of confidence, one at the .01, one at the .05, and one failed to be con-
firmed at the .10 level of confidence. With respect to the latter prediction, it had been predicted that following low invalidation of predictions, reconstruction on Pr constructs would be greater than on Co constructs. While the difference was in the predicted direction, it was not large enough so that one could reject the null hypothesis. Accepting this result at its face value for the moment, one would infer from it that under conditions of low invalidation there is no difference in the amount of reconstruction on Pr and Co constructs. Further research would be needed to confirm this.

Prediction number five, which was supported at the .001 level of confidence, was deduced from the miniature system but cannot be directly related to any of the three propositions under investigation. Its support is consistent with these propositions but not necessary.

Predictions numbered six through nine were designed to test our second proposition. Of these, one was confirmed at the .05 level, one between the .05 and .10 level, one, whose confirmation involved acceptance of the null hypothesis, was confirmed by the difference not being significant at the .10 level, and the last failed to receive support, not reaching significance at the .10 level of confidence. Thus, of the four predictions designed to test the second proposition, only two received support.

Our last proposition was tested by prediction number ten. This was confirmed at the .001 level of confidence.

Considering the more general question of the relationship between relative information value and the classification of constructs as either Co or Pr, it might be said that there is presumptive evidence for its
validity in that seven of the ten predictions derived from a system where information value functioned as an intervening variable were supported at statistically acceptable levels of significance.

In considering the negative findings as well as the positive, it should be noted that there are several sources of error which could account, in part at least, for these results. One of these is the criterion by which constructs are classified as either Co or Pr. This classification was based on assumptions regarding a more orthodox type of factor analysis than that performed in this study. The relationships between Kelly's nonparametric equivalent and orthodox factor analysis remains to be determined.

Another possible source of error is in the limited sample of both kinds of constructs employed. It is quite possible that had a larger number of each type of construct been employed, trends such as those noted in Figure Two (p. 59) might have been more sharply defined.

We have no evidence as to the construction which subjects put upon the experimental situation itself and what effect this might have had on our results. From observation of the subject in the performance of the prediction and construction tasks set for him, there seemed little doubt in the experimenter's estimation that he was involved in it and accepted the tasks as genuine. Some doubted their ability to do well in these tasks, but all seemed to expend considerable effort in their execution.

But, beyond the problem of involvement and motivation is the question of the construction subjects put on the experimenter's efforts to produce high and low invalidation. This, of course, is the problem faced by any experimenter who attempts to manipulate the experiences of
subjects during an experiment. We have as yet no criteria for knowing that we have produced the type and degree of experience that we desire. Since some of our predictions which were predicated on the presence of a certain type of experience, e.g., high invalidation, were supported, we might accept the likelihood that we were successful in our efforts. However, this must be tempered by the fact that other predictions were not supported.

The Control for Bias

In Chapter Four we mentioned the problem of controlling for bias in the selection of predictions items. The question had been raised as to whether reconstruction on either Co or Pr constructs might not show greater changes in predictions because more of the prediction items were related to one or the other of these two types of constructs. It was pointed out then that such a question made assumptions as to the nature of these two types of constructs which were counter to our assumptions, but nevertheless, that this question might be met by empirical evidence.

The evidence we proposed was that of making contrary predictions as to changes in subject's predictions occurring as a function of the amount of reconstruction on Co and Pr constructs. Thus, we predicted that where reconstruction on only one Co construct was contrasted with reconstruction on only one Pr construct, greater changes in predictions would follow reconstruction on the Co construct. But, where reconstruction on four Co constructs was contrasted with reconstruction on four Pr constructs, we predicted that greater changes in predictions would be associated with changes on Pr constructs. It should be noted in
passing that these contrasting predictions were consistent with our assumptions as to the relative amounts of information and redundancy for any given number of Co and Pr constructs.

The pertinent results, given in predictions six and seven, while not reaching a statistically acceptable level of significance, are in the predicted direction. This, together with our finding that judges could not discriminate between Co and Pr constructs, lends some support to the argument that the results obtained are not a function of bias in selection of prediction items.

In the final analysis, how much of one's results are attributable to error and how much to the operation of the variables hypothesized, can only be determined by continued investigation in which each possible source of error is systematically varied. Recognizing these limitations we shall now attempt to evaluate the significance of the results of this study. In embarking on this venture we shall take our results as being generally confirmatory of the relationship between constellatoriness and information value on the one hand, and between information value and susceptibility to change following invalidation on the other hand.

General Theoretical Implications

On a most general level the results of this study appear to demonstrate that one can apply a nomothetic approach to the unique verbal productions of an individual and make predictions which hold up at highly respectable levels of statistical significance. In this, our findings would appear to be in agreement with Allport's (3, p. 23) contention that there is no necessary antipathy between the idiographic and nomothe-
tic approaches to behavior study.

Although we made direct use of the individual's verbal productions, we were able to subject these to experimental manipulation and fit them into a conceptual structure without once being concerned with the semantic meaning of these productions, i.e., we were not concerned if our interpretation of an individual's construct was the same as his interpretation. Thus, it would appear that the RCRT permits us to work within the individual's frame of reference, at least so far as the prediction of changes in construction and construct related behavior is concerned.

Taking Morris' theory of signs (27) as a point of departure, and viewing this study in terms of his three areas of investigation, viz., syntactics, semantics, and pragmatics, we might conclude that this study has been one of the syntactical relationships obtaining in individual construct systems. We have investigated some of the relationships that constructs might have with each other, but we have left relatively untouched the relationship between constructs and the elements subsumed by them, and between constructs and the person using them. These remain to be studied.

One generalization from our data which might be made, and which might find fairly wide application, is the nature of the relationship between information value and susceptibility to change. If behavioral variables or responses in any situation can be rated for their information value, the prediction would follow that those responses having high information value would be less susceptible to change under conditions minimally different from those in which they were developed; whereas conditions radically different from the conditions under which
the response was developed would result in more extensive changes in high information value responses. This of course assumes that changes in conditions are of sufficient magnitude to make the particular responses in question less appropriate.

Taking a simple generalization study as an example, if the responses could be given differential information value, then we would predict that high information value responses would show less generalization than low information value responses. If we interpret each reinforcement as giving the individual some additional information about his environment, then the usual findings that as the number of reinforcements of the response at one stimulus point increases the generalization gradient becomes steeper, lend support for our inference.

This leads immediately to the more general problem of the variables of which information value is a function. While information value is said to be equal to the logarithm of the number of equally probable alternatives in a given situation, it is also true that all individuals may not have the same number of alternatives available to them. In terms of Social Learning Theory (30), all individual's do not have the same amount of freedom of movement in a given situation and the problem is one of studying the determinants of freedom of movement. Thus on a general level we would be interested in how the number of possible responses in a given situation builds up for different individuals.

As it was used in this study, the information value of a given response was also a function of its correlation with other responses. Research and theory could be directed toward discovering those variables
of which this correlation is a function.

In our review of the literature we attempted to draw inferences, utilizing information theory, from both human and infrahuman studies. Because information theory, as it is now formulated, does not rest upon semantic meaning or understanding and carries no implications of higher level thought processes, it may provide at last one means of rapprochement between animal and human experimentation. In this study we believe we have demonstrated that concepts used by college students can be rated for their relative information value; by various experimental arrangements responses learned by animals could be similarly given differential information values and we would then have the basis for a truly comparative psychology.

This study also has certain implications for the value of Personal Construct Theory as a theory of behavior. This study as well as Bieri's (5) has demonstrated that constructs as elicited by the RCRT are amenable to quantitative treatment and that predictions concerning them can be made in a roughly quantitative fashion with fairly significant results.

Since our miniature system was based on the presupposition of the dichotomous nature of constructs, and to the extent that our predictions have held up, we seem justified in concluding that such a presupposition was justified.

Our findings also indicate that construct repertoires have structures, i.e., that constructs are not discrete units but related to each other. This study has demonstrated that they are related by way of being differentially correlated with each other. Kelly maintains that
constructs hold ordinal relationships to each other. It is quite possible that this ordinal relationship between constructs accounted for some of the variance in each subject's repertoire. A reasonable assumption, however, would be that there are both ordinal and equivalence relationships between constructs. Further research should be directed toward instruments which might isolate these two types of relationships. If such relationships could be delineated, more precise statements could be made as to the information value of given constructs since, among other things, the differential in information value would probably be greater between a superordinate and subordinate construct than between two equivalent constructs.

Characterizing construct repertoires as high and low in total information value or in amount of redundancy between constructs, it is possible that we have here an analogue to Tolman's broad and narrow cognitive maps (35). For Tolman the rat with the broad cognitive map of his environment is likely to engage in more exploration and find alternate routes to goal boxes than is the rat with the narrow strip map of his environment. The low information value repertoire would seem similar in operation to the narrow cognitive map while the high information value repertoire would parallel the broad cognitive map. In other words, the individual who has a low information value repertoire has few ways of construing any given problem and hence has fewer alternative responses which he might make in the situation than the individual with a high information value repertoire.

From the foregoing discussion, the inference might be made that by means of utilizing Personal Construct Theory we are now able to
characterize the information handling capacities of individuals in situations somewhat more complex than rote learning and simple discriminations. Information handling capacity, which might be taken as being reflected by the information value of the individual's construct repertoire, thus becomes another variable against which functional relationships can be sought for other behavioral variables. We would be particularly interested then in the implications of this approach for both social psychology and clinical psychology.

Implications for Social Psychology

If interpersonal relations are dependent upon interpersonal communication, and if we accept the constructs used by an individual as his means of coding information and communication, then from a knowledge of the structure and information value of an individual's or group's construct repertoire certain predictions should be possible about the quality and nature of both communication and relationships for both the individual and the group as a whole.

Specifically, one would predict that the person with a low information value construct repertoire would have more difficulty in communication, both in terms of transmission and reception. By the same token, he would also be the most difficult person in whom to bring about attitude change by means of verbal communication. Such predictions would be based on the assumption that the individual with low information handling capacity is insensitive to all but the most obvious stimuli in his environment and would lack sensitivity to the more subtle nuances of communications.

The interpersonal relations of the individual with low information
handling capacity, in contrast to those of the individual with high information handling capacity, would be more likely characterized by sharp cleavages as between in-groups and out-groups.

With regard to the current interest in the characteristics of the authoritarian personality (2), one would predict that his constructs would show higher intercorrelation between them and hence possess less information value as a whole.

Leadership studies might also make good use of certain implications of this study. One would be immediately interested in knowing whether the construct repertoires of leaders differ from those of non-leaders. Similarly the question of the specificity or generality of leadership might be studied from this same approach. Do differences in construct repertoires of leaders and non-leaders, providing they exist, remain fairly constant from one type of group situation to another? Information value of course is just one dimension upon which construct repertoires could be compared.

Implications for Clinical Psychology

The concept of information handling capacity was introduced in the preceding discussion as an attribute characterizing individuals having high or low information value construct repertoires. Within the proper province of clinical psychology would come the investigation of the generality of this information handling capacity for any given individual over various areas of personal adjustment, e.g., sex, peers, etc. One might expect that information handling capacity, like freedom of movement or anxiety level, would vary from one behavioral area to
another and perhaps from one time to another. The psychologist interested in individual differences and clinical psychology might then study the determinants of information handling capacity. He might also, by an appropriate experimental design, determine whether we are justified in positing a one to one relationship between information value of construct repertoires and information handling capacity.

Important as behavioral change is in psychotherapy, the relationship found in this study between information value and conditions under which responses are likely to change, should have some value.

By means of a factorial treatment of an RCRT protocol, the therapist should be in a position to predict those areas in which his client is most likely to show rigidity. Specifically, the therapist would expect his client to be most rigid in those areas where he most often applies constellatory constructs. This should have both diagnostic and therapeutic importance.

Diagnostically, one would predict that an individual would have most difficulty in relating in anything but a superficial manner with those persons whom he construes in a constellatory manner. One might say in such instances that the individual is probably responding more to the constellation than to the person construed. Clinical research might be geared toward revealing those conditions under which an individual will utilize constellatory constructs in construing another individual.

Therapeutically, the presence of a large number of constellatory constructs in a protocol is an indication that areas to which these
Constructs are applied had best be attacked with caution lest a sudden reconstruction or loss of structure occur on these constructs and result in marked and unwise behavioral changes in the individual—perhaps to the extent that he is unable to maintain reality contact.

One might suspect that where large constellations occur it would be best to bring about reconstruction of individual elements subsumed by the constellation rather than attack the constellation itself. The ultimate problem is one of reducing the constellatory nature of the individual's constructs but not to the point of complete fragmentation. This is a problem for which well defined techniques are still lacking.

This brings us to a normative problem concerning the degree of constellatoriness or propositionality which is most desirable in a construct repertoire. If it is the amount of relationship between two constructs which permits the individual to form propositions of the nature "If x then y", then complete independence between all of the constructs in an individual's construct repertoire would leave him completely at sea in terms of making predictions and generalizations. On the other hand, if all constructs were perfectly correlated with each other, again the individual would be at a loss in dealing with a changing world. While neither of these extremes seems likely of occurrence, the question can be posed as to whether there is an optimal point between them.

If the most natural condition for construct repertoires is one where a certain amount of correlation exists between some of the constructs, but not between all of them, then from a developmental point of view one would be interested in knowing the directional tendencies
for these correlations; do they increase or decrease with growth. This of course is the familiar question of whether development and growth proceed from an undifferentiated whole, through stages of individuation, to an integrated but differentiated whole, or whether the process is the reverse, starting with discrete elements and building up to an integration of these elements. In the former case one would expect with increasing age a decrease in the intercorrelation present in a construct repertoire until an asymptote was reached, while in the latter one would expect intercorrelations to increase with age until they reached an asymptote. If the information handling capacity of the individual is contingent upon the structure of his construct repertoire, then we would expect the former case to be true since it is most reasonable to assume that information handling capacity increases up to a point with age.

Summary

In this chapter we have attempted to evaluate the implications of this study in the areas of general theory, social psychology, and clinical psychology. It was suggested that information theory may have a wider range of application than it enjoys now, in that it may provide a valuable dimension against which to study other variables. Personal Construct Theory, by virtue of its unit of analysis, the construct, seems particularly amenable to the use of information theory. Research problems were suggested in terms of both information theory and Personal Construct Theory.
As Hull (13) has pointed out, theories, and to a lesser extent theoretical orientations, do not stand or fall on the results of one experiment. The experiment with its results represents a phenomena which the theoretician can appeal to in support of his theory. To the extent that the theorist can demonstrate a congruence between the terms in which the phenomena are structured and the terms of his theory, he has met with some success. From the point of view of Personal Construct Theory, phenomena can be construed in many different ways and hence could presumably be brought to the support of many different theories. It would therefore be inconsistent for us at this point to preempt the results of our experiment for Personal Construct Theory, for a cognitive orientation to behavioral research, or for the particular miniature system which we constructed in this dissertation.

What we do claim for our orientation, theory, and miniature system is: (a) that they generated the thinking which led to this particular research, and (b) that they seem to be a parsimonious and consistent way of accounting for our results. This, we believe, is about the most which one can ask of any theory.

Taking the measure of information, as defined by information theory, and applying this to personal constructs elicited by the RCRT and treated by Kelly's nonparametric equivalent for factor analysis, certain inferences were made as to the information value of two types of constructs,
constellatory and propositional. We hypothesized a relationship between sensitivity to invalidational evidence and information value of constructs and then made the following predictions: (a) Under conditions of low invalidation of construct related behavior, there would be more extensive changes in construction on propositional constructs than on constellatory constructs; (b) Under conditions of high invalidation of construct related behavior, changes in construction would be more extensive on constellatory constructs than on propositional constructs; (c) Constructions on constellatory constructs are generally more resistant to change than are constructions on propositional constructs.

It was also predicted, as a function of the relationship which we postulated between information value and behavior, and between type of construct and information value, that forced reconstruction on one constellatory construct would lead to greater change in construct related behavior than would forced reconstruction on one propositional construct. On the other hand, where reconstruction on four constellatory constructs was compared with reconstruction on four propositional constructs, we predicted that greater changes in construct related behavior would be associated with reconstruction on the propositional constructs.

Finally, making use of the concept of deutero learning, we predicted that, when given the opportunity, subjects would select their constellatory constructs over their propositional constructs for amount of information conveyed by them when they are used in the construction of an individual.

Seven of the ten predictions were supported at statistically acceptable levels of confidence. Most strongly supported was the prediction
that subjects would rate their constellatory constructs as having higher information value than their propositional constructs. Predictions concerning degree of invalidation of construct related behavior and reconstruction on constellatory and propositional constructs were also supported, but not at very significant levels. Also supported, but less strongly, were predictions involving forced reconstruction on constellatory and propositional constructs and attendant changes in construct related behavior.

The results were taken as generally supporting our theoretical position and implications were discussed for general behavior theory, social psychology, and clinical psychology.
Bibliography


APPENDIX A

Raw Data
### Table Three

**Raw Data Indicating Effects of High and Low Invalidation**

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APPENDIX B

Materials used:

1. Role construct repertory test.

2. Prediction questions

3. Paired comparisons for Co and Pr constructs.
1. Write your own first name in the first blank here.

2. Write the first name of your mother or the person who has played the part of your mother in the next blank.

3. Write the first name of your father or the person who has played the part of your father in the next blank.

4. Write the name of your brother nearest you own age or the person who has played the part of such a brother.

5. Write the name of your sister nearest your own age, or the person who has played the part of such a sister.

6. Your wife (or husband) or closest present girl (boy) friend. Do not repeat the name of anyone listed above.

7. Your girl (boy) friend immediately preceding the person mentioned above. Do not repeat any names from this point on.

8. Your closest present friend of the same sex as yourself. Do not repeat names.

9. A close friend of the same sex in whom you have since been badly disillusioned. Do not repeat names.

10. A person with whom you have worked who, for some unexplainable reason, appeared to dislike you. Do not repeat names.

11. The person whom you would most like to help or for whom you feel sorry. Do not repeat names.

12. The person with whom you usually feel most uncomfortable. Do not repeat names.

13. The person whom you have met in the past six months whom you would most like to know better. Do not repeat names.

14. The teacher who influenced you most when you were in your teens. Do not repeat names.

15. The teacher whose point of view you have found most objectionable. Do not repeat names.

16. An employer, supervisor, or officer under whom you served during a period of great stress. Do not repeat names.

17. The most successful person whom you know personally. Do not repeat names.

18. The happiest person whom you know personally. Do not repeat names.

19. The person known to you personally who appears to meet the highest ethical standards. Do not repeat names.
Write your own first name in the first blank here.

Write the first name of your mother or the person who has played the part of your mother in the next blank.

Write the first name of your father or the person who has played the part of your father in the next blank.

Write the name of your brother nearest you own age, or the person who has played the part of such a brother.

Write the name of your sister nearest your own age, or the person who has played the part of such a sister.

Your wife (or husband) or closest present girl (boy) friend. Do not repeat the name of anyone listed above.

Your girl (boy) friend immediately preceding the person mentioned above. Do not repeat any names from this point on.

Your closest present friend of the same sex as yourself. Do not repeat names.

A close friend of the same sex in whom you have since been badly disillusioned. Do not repeat names.

A person with whom you have worked who, for some unexplainable reason, appeared to dislike you. Do not repeat names.

The person whom you would most like to help or for whom you feel sorry. Do not repeat names.

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The happiest person whom you know personally. Do not repeat names.

The person known to you personally who appears to meet the highest ethical standards. Do not repeat names.
Instructions

Below are a list of questions concerning the behavior of the person whose picture you have seen. In each case you are to make a "best guess" as to which alternative would be true for him. When you have made your decision circle the letter next to the alternative which you believe would be true.

1. With regard to going to parties, this person usually:
   a. Jumps at the opportunity.
   b. Regards them as a "bore" and goes rarely.
   c. Will decide whether to go on the basis of who will be there.
   d. Regards them as a "bore" but goes anyway.
   e. Just isn't interested.

2. When he thinks about the future he:
   a. Is full of wonder and enthusiasm.
   b. Has doubt about his ability.
   c. Can see mostly calamity.
   d. Is full of plans--has it all worked out.
   e. Can't get very interested--more concerned with the present.

3. In meeting people for the first time he:
   a. Has difficulty keeping up his end of the conversation.
   b. Stays on very superficial topics.
   c. Attempts to discover the other person's interests.
   d. Tries to size them up as "interesting" or "uninteresting"
      and then decides how to talk to them.
   e. Only talks about himself.

4. When he thinks about his family he is:
   a. Embarrassed about them.
   b. Proud of them.
   c. Fond of them but glad to be away.
   d. Very worried about them.
   e. Glad to be away from them.

5. At school he:
   a. Enjoys most of his subjects.
   b. Tries to get away with as much as possible.
   c. Sees it as a hurdle to be gotten over.
   d. Is a playboy.
   e. Sees it as a way of getting a good job.

6. His childhood was generally:
   a. Ideal.
   b. Confused.
   c. Unhappy.
   d. Deprived.
   e. Happy.
7. He meets emergencies when they arise by:
   a. Going to pieces and giving up.
   b. Remaining calm but not accomplishing much.
   c. Remaining calm and working out a practical solution.
   d. Trying one approach after another without giving any a chance to succeed.
   e. Crying for help.

8. His social philosophy could be summed up by:
   a. All for one and one for all.
   b. It's every man for himself.
   c. Life is a wonderful adventure.
   d. We each have a purpose in being here.
   e. This world would be better off if certain types of people weren't around.

9. His general emotional adjustment is probably:
   a. Very good.
   b. Above average.
   c. Average.
   d. Below average.
   e. Very poor.

10. If asked to join a fraternity he would:
    a. Join because the "contacts" would be helpful.
    b. Join because it would mean a lot of fun.
    c. Weigh the advantages and disadvantages carefully before considering it seriously.
    d. Not join because they are too "snobbish".
    e. Not join because they are too immature.

11. Dating for him is:
    a. Enjoyable.
    b. Difficult
    c. Strictly a means to an end.
    d. Easy but uninteresting.
    e. About the only thing he's interested in.

12. When confronted by a difficult personal problem he:
    a. Immediately seeks the advice of an older person.
    b. Tries to work it out himself.
    c. Feels at a complete loss.
    d. Will work it out as far as he can and then seek help.
    e. Will try to find a way of forgetting about it.

13. Intellectually he is:
    a. Very intelligent.
    b. Above average.
    c. Average.
    d. Below average.
    e. Dull.
14. He is probably majoring in:
   a. Engineering.
   b. Business administration.
   c. Education.
   d. Physical education.
   e. Art.

15. He probably believes that women:
   a. Belong in the home.
   b. Should have equal rights.
   c. Are meant for his pleasure.
   d. Are hard to understand.
   e. Are not as mature as men.
Below are 25 comparisons of pairs of terms which you have used in describing people. For each comparison pick that pair which for you would tell the most about a person if he were described in those terms. For example, if you had never met a person but he was described to you in some of the terms which you have used, which terms would help you to feel that you really knew this person well. Consider each comparison independently of all the rest.

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***************
I, Leon Harris Levy, was born in Paterson, New Jersey, December 24, 1925. I received my secondary education in the public schools of Paterson, New Jersey. After a period of service in the armed forces, I enrolled in Antioch College from which I received the degree Bachelor of Arts in 1950. I entered The Ohio State University in 1950 and received the degree Master of Arts in 1951. While in residence at the Ohio State University, I received an appointment as teaching assistant for the year 1951-52. As part of the training program in clinical psychology I was engaged in an internship in the public school system of Dearborn, Michigan during the year 1952-53. During the year 1953-54, I received an appointment as United States Public Health Service Scholar. It was during this appointment that I completed the requirements for the degree Doctor of Philosophy.