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A Study of the Relation between Deductive and Inductive Reasoning Ability and Adjustment in Adults

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A STUDY OF THE RELATION BETWEEN DEDUCTIVE AND INDUCTIVE
REASONING ABILITY AND ADJUSTMENT IN ADULTS

by

Mary McNeill

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

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CHAPTER I

STATEMENT OF THE PROBLEM

It is the purpose of this study to find the relationship between reasoning ability and personal adjustment. As a result of the studies of Spearman, Alexander, and Thurstone, reasoning ability is now recognized as one aspect of intelligence: factor analysis makes it possible to isolate and quantify a reasoning factor. "Reasoning", Ruch states, "is a characteristic differentiating man from other creatures."¹ Maher has expressed it more descriptively for our purposes when he writes that reasoning is "that operation by which we derive a new judgment from some other judgment or judgments previously known."²

Specifically our purpose is to discover whether "over deductiveness" is associated with poorer adjustment, if the "intellectualizer" is less able to adjust satisfactorily than his opposite number who reasons in an inductive way.

Deductive reasoning, or syllogistic reasoning, as an act of intelligence has long been accepted as a high form of intellectual activity. We know from

¹ Ruch, Floyd B., Psychology and Life, Scott, Foresman, New York, 1937.

² Maher, M., Psychology: Empirical and Rational, Longmans, Green & Co., London, 1919, p. 320.

studies of Terman and Merrill, and Wechsler, to cite but a few of the better known and more significant sources, that the deductive process is closely allied with intelligence. As tested, the ability to reason deductively varies significantly with age, taking time to mature. Most writers would agree that while it seems to be parallel with intelligence, it is many years behind it in development. One of the bases on which this study is undertaken is that the relationship between deductiveness and adjustment will also shift with age. Hence our plan to test age differences as a secondary hypothesis.

Perfection of the form of deduction is attributable to Aristotle; and from his time forward, man's interest in logic has been largely with the discipline per se. Morgan and Morgan state that "psychology seems to be under the delusion that logical reasoning is confined to the syllogism, a view which has long been abandoned by the logicians themselves." To support this statement, they quote Prof. G. A. Miller in Steven's Handbook of Experimental Psychology, p. 806: "The fact is that logic is a formal system just as arithmetic is a formal system, and to expect untrained subjects to think logically is much the same as to expect preschool children to know the multiplication table."³

Only rarely have any studies been made of the deductive thinking process. Wherever such research is recorded, however, the studies are, says Woodworth, of two kinds:

³ Morgan, W., and A. B. Morgan, "Logical Reasoning: With and Without Training", Journal of Applied Psychology, 1953, 37, p. 399.

- a. "investigations of children's ability to do deductive thinking; and
- b. studies tending to analyze the process itself, to break it down, to question its validity."⁴

Koffka, in his introduction to Duncker's book, offers two reasons for the scant concern that has been shown by psychologists about the thought processes: it is possible that many believe thinking is not a subject matter with any specific characteristics of its own; or, as psychologists we like our experimental procedures so much that a subject matter to which these procedures cannot easily be applied has little chance of arousing our interest.⁵

At the present time, however, there is evidence of a "revival" in theories of cognitive processes as a means whereby man achieves, retains, and transforms information. This revival has been stimulated in no small measure by the arresting changes in personality theory over a long period of time. At first personality theorists were interested in cognitive activity only when and to the degree that it gave them some information about how "rational" processes could become subjected to "drives" and "defenses". With the appearance and acceptance of psychoanalysis and ego psychology, the "synthetic functions" of the ego become more and more demanding of study and understanding.

⁴ Woodworth, R., Experimental Psychology, Henry Holt & Co., 1938.

⁵ Duncker, K., "On Problem Solving," Psychological Monographs, 1945, 58, no. 5, whole no. 270, p. iii.

Most of the earlier studies of thinking proceeded from the psychopathological aspect, and, indeed, the majority of those conducted in more recent times have the clinic or a clinical hypothesis as a starting point. It is accepted that the intact, healthy person can organize his perceived environment and reorganize it to satisfy his needs. Goldstein, a German neurologist, approached the psychopathology of thought from a Gestalt point of view, finding the associationistic concept of reflexes inadequate to explain or even to describe the symptoms of war veterans with head injuries. The troubles of these patients he said consisted not of isolated traits, but in coming to terms with the total environment. The brain-injured patient, as compared with the healthy person described above, was bound to one view of his situation and task. His brain injury resulted in a fixed, concrete attitude towards the materials at hand, in organizing them one way, or adopting another attitude and organizing them another way. In the behavior of these persons there was no evidence of the normal person's capacity for abstract thinking, for shifting from one approach to another. With his students, Goldstein devised tests of concrete and abstract thinking that have been widely used in psychological clinics.

Ach of the Wurzburg school developed tests of concept formation or abstract thinking. These were followed by tests of Vigotsky,⁶ and Weigl, and Hanfmann- Kasanin's revision of the Vigotsky block test.⁷ This latter was

⁶Vigotsky, J., "Thought and Speech," Psychiatry, 1939, 2, 29-54.

⁷Hanfmann, E. M. and J. Kasanin, "A Method for the Study of Concept Formation", Journal of Psychology, 1937, 3, 521-540.

developed to check Vigotsky's contention that the essence of schizophrenic disorders lies in a loss of ability to think in abstract conceptions; that these patients regress to a more primitive level where objects are not viewed under general categories but are seen merely as individuals. This represents an extension of Goldstein's position reached from his study of brain injuries. The most important contribution of these theorists is that a reduction in the level of conceptual thinking occurs in some schizophrenics but is lacking in others.⁸ Vigotsky made a simple division of thinking into conceptual and concrete (complex) thinking. Hanfmann and Kasanin developed three levels. Moreover, they cannot agree with Vigotsky that conceptual thinking is a possession of every normal adult. Vigotsky, following Piaget and Goldstein, and Gelb and Goldstein⁹ on the basis of results attained with the Ach-Sakharov test, concluded that children before puberty are confined to concrete complexes and only after puberty develop genuine abstraction.¹⁰

Professional people working with the mentally disturbed report that more and more information is necessary about the dynamics of abnormal behavior in all of its manifestations since many of the behavior disorders involve intellectual functions. Studies of set, ethnocentrism, and rigidity

⁸ Hanfmann, E., and Kasanin, J., "Conceptual Thinking in Schizophrenia", Nervous Mental Disease Monograph, 1942, no. 67.

⁹ Goldstein, K., and Scheerer, M., "Abstract and Concrete Behavior," Psychological Monographs, 1941, 53, No. 2, Whole No. 239.

¹⁰ Vigotsky, J., "Thought in Schizophrenia," Archives of Neurology and Psychiatry, 1934, 31, 1063-1077.

conducted by Luchins, Frankl-Brunswick, and Rokeach imply a relationship between the kind and degree of reasoning ability and attitude. Hanfmann and Kasanin have reported marked differences on their test in the performance of schizophrenics, normals, and cases of organic damage.¹¹

Possibly as a result of this heightened interest and activity in clinical psychology there is a marked curiosity about the way people use their intelligence. Growing out of studies of personality are the concept formation tests cited above, and tests by Kuo,¹² and Hull,¹³ Moore,¹⁴ Robitaille,¹⁵ Thurstone,¹⁶ and Eggert¹⁷ have developed tests to measure ability

¹¹ Hanfmann, E., and Kasanin, J., "A Method for the Study of Concept Formation," Journal of Psychology, 3, 1937.

¹² Kuo, Z. Y., "A Behavioristic Experiment on Inductive Inference," Journal of Experimental Psychology, 1923, 6.

¹³ Hull, C., "Quantitative Aspects of the Evolution of Concepts," Psychological Monographs, No. 123, 1920.

¹⁴ Moore, T. V., "The Reasoning Ability of Children in the First Years of School Life," Studies in Psychology and Psychiatry, Catholic University of America, Baltimore, II, no. 2, April, 1929.

¹⁵ Robitaille, H. J., "The Development of a Test for Reasoning Ability and Its Application to Students Majoring in Science, Classics, and Commercial Courses," Studies in Psychology and Psychiatry, Catholic University of America, Baltimore, VI, no. 3, September, 1943.

¹⁶ Thurstone, L. L., "Primary Mental Abilities," Psychometric Monograph, no. 1, Chicago, University of Chicago Press, 1938.

¹⁷ Eggert

to think deductively. Burack¹⁸ has investigated the nature and efficiency of methods used in solving reasoning problems.

One of the more recent outcomes of studies such as these is the increasing interest in the relationship between reasoning ability and perception and of perception and personality. What Bruner, Goodnow, and Austin call "the 'new look' in perception" began by trying to seek out manifestations of autism in perceiving. This was soon changed into a search for links between general laws of perception and cognition on one side, and general laws of personality functioning on the other. Bruner and his co-workers have reported the results of their five year research project in Cognition at the Laboratory of Social Relations at Harvard University. They are among that group in psychology who are "seeking to describe what happens when an intelligent human being attempts to sort the environment into significant classes so that he may end by treating discriminably different things as equivalents."¹⁹

Possibly at no other time in the history of psychology has there been so much curiosity shown by so many about the problem of personal adjustment as we witness it today. Surprisingly enough, this interest is not confined to the psychological clinic, the therapist's consulting room, or the experimental laboratory.

¹⁸ Burack, B., "The Nature and Efficiency of Methods of Attack on Reasoning Problems," Psychological Monographs, no. 313, 1950.

¹⁹ Bruner, J., Goodnow, J., and Austin, G., A Study of Thinking, New York, Wiley, 1951.

That the Mental Health movement is in large measure responsible for articulating desirable and workable goals of personal adjustment in terms and concepts understandable to the average layman goes without saying. Today's adults and young adults have become remarkably sophisticated and frequently glib in their knowledge of what constitutes "good" personal adjustment. This is not to imply that the ratio of such good adjustment to knowledge of it is in direct proportion. On the contrary, a tremendous amount of work remains to be done before there is a satisfactory balance. All of this is, however, but further evidence of the fact that there is almost teeming activity in the psychological research being done in this area, with the output and feedback of information proceeding at a heartening, awesome, and truly extraordinary rate.

CHAPTER II

REVIEW OF THE LITERATURE

In the introduction to his Organization and Pathology of Thought Rapaport states that while psychology has become "much concerned with motivation and personality, it has paid little attention to the mediation-processes through which 'personality structure' and 'motivation' translate themselves into action or, more broadly, behavior." In a wider sense, thought processes have been little studied, and even in the field of memory, he continues, where the role of motivation and personality has been more consistently studied than in other fields of thought-organization, the investigations have not persisted to the point of conclusive results. In seeking reasons, he suggests as did Koffka cited above, that the reasons for this regrettable situation lie partly in the subtlety of the processes in question, which defy the method of exploration used, and partly in the lack of a comprehensive theoretical framework. While in the last few years the relation of perception to motivation and personality has been shifting closer to the center of attention, he comments that even there the mediation-processes have been "little regarded."

Tracing further such manifestations of interest in the thought processes as were to be found, he states that even in clinical psychological testing, which obviously deals with thought products, the interest in the thought processes underlying them was, until recently, minimal. "On the one hand,

mechanical conclusions from scores as to nosological categories and traits and types of personality, and on the other, inferences from thought contents as to 'dynamics', were and are still accepted practice, in disregard of the thought processes mediating these connections. The same problem holds in the work of the clinical psychiatrist", he continues. "The psychiatric examination and case history are admirable tools in the hand of the experienced clinician. But their limitations are also admittedly great: they use general characteristics of life history, thought contents, and empathic observations as the basis for judging pathology and personality. Yet between the processes termed personality and its disorders on the one hand, and observational data on the other, there are mediating thought processes. The responsibility for the expression of the personality in observational and test data is not equally shared by all those processes which are subsumed under the construct, personality; the thought processes bear a greater and more direct share. These thought processes do not always reveal themselves in contents, nor are the contents communicated by the subject individually characteristic outside of a certain range. There is accumulating evidence...that to know more about the individuality of thought we must better understand the formal characteristics of thought processes."¹

Rapaport's idea is neither new nor, consequently, startling. The same observations have been made by psychologists who have articulated the problem and, within the limitations listed by Rapaport, endeavored to do something

¹ Rapaport, David, Organization and Pathology of Thought, New York, Columbia University Press, 1951, 4-5.

constructive about it. His statement is, nevertheless, the obvious and comforting sort of truth that requires no searching or recondite proofs to make it credible. Search of the literature yields little by comparison with research in other fields in psychology.

Johnson in his book The Psychology of Thought and Judgment, offers the observation that the great bulk of work done in studies of thought has been accomplished in recent years. In tallying references in his text alone, he finds that from 1950 to the date of his writing (1955), 185 studies had been published having to do with the thought processes. In the preceding ten-year interval there were 305 studies reported; and a gradual increase in the numbers of these studies is traced from the meager two which were reported in the interval 1890-1899.²

Morgan and Morgan in 1953 wrote that on their "careful search of the literature since 1927" they found twenty-one references to studies of logical reasoning; and they allude to their "generous interpretation" of which constitutes an experimental study.³ At the University of Hawaii students in a graduate seminar compiled a bibliographical listing of psychological research having to do with "Inductive and Deductive Processes". They list some two hundred and fifty sources, and state that the list "is oriented as directly as available sources permit to the study of inductive and deductive behavior

²Johnson, D.M., The Psychology of Thought and Judgment, New York, Harper's Bros., 1955, ix.

³Morgan, W., and Morgan, A., op. cit.

in human thinking".⁴ The sources are classified in nine categories and inclusion in these is, they admit, in some instances arbitrary. They state as their aim in this compilation "the identification of the literature concerned with inductive and deductive behavior, to focus on possible distinctions between them, and to provide a basis for further research.

In accumulating pertinent research for this study, it has been necessary to limit its scope. Proceeding from an admission of "perception" as a necessary starting point, we have then considered such related studies as dealt with motivation, set-rigidity as they are seen as facets of personality, representative studies in the pathology of thought and reasoning, and, finally, the inductive and deductive methods as means of exploring reasoning ability.

In any consideration of the reasoning processes we are confronted with the interesting fact that studies of this subject have expanded considerably and remarkably in their scope from the earliest attempts in this direction. In the same way that we can trace an increase in number of studies of personality and the expansion of the concept "personality" to include the phenomena of perception, need-and-drive-states, and individual differences, so too, in the literature of the thought processes we see the subject expanding from the typical and, in a sense, classical studies of Heidbreder, Woodworth, and Hull for example, to include the more recent ones at Harvard, McGill and

⁴"Inductive and Deductive Processes: A Bibliographical Listing for Psychological Research", Compiled by the University of Hawaii Graduate Seminar, 1958.

The University of Southern California.

It has been said that if there were no natural tendency for man to divide the world up into concepts, he would have to invent one. We accept the fact that man has the ability to categorize, to "render discriminably different objects equivalent," to group objects, events, and people around him into classes, and to respond to them as members of a given class rather than as unique entities. We attribute to him "cognitive motivation" or categorizing motives which, we say, are man's attempt to reduce his environment from a complexity of unordered events to a simplicity of ordered groups. Studies have shown that these cognitive motives do exist, and in the thinking of different investigators they are conceived with slight differences. Thus, Tolman posits a "placing need", Hilgard offers two goals of perception, clarity and stability, and Woodworth describes a "will to perceive".

To a degree these theories have been satisfactory as describing man's cognitive needs, but within the past decade there has been evidence that they are not sufficient, and that the theory must go beyond these basic conceptions.

We know that man acquires concepts either by simple learning, by complex learning-problem solving-, or by a combination of these. Hull⁵ and Kuo's⁶ experiments indicate that simple concepts are simply and gradually acquired. Concepts on a higher level of abstraction depend less on practice and memory

⁵Hull, C. L., op. cit.

⁶Kuo, Z. Y., op. cit.

and, as in the case of Heidebreder's persistent investigations in this area, become more a matter of "pure" discovery.⁷

In trying to learn how a person discovers a principle that allows him to solve a problem we find that his activity varies between the production of hypotheses and the testing of them. Heidebreder's earliest study described the difference between participant behavior and spectator behavior. She included in the first category the active testing of hypotheses, and in the second, where there was scarcely any overt activity, the production of successful hypotheses. It has been suggested that probably both kinds of action cannot be produced simultaneously, but research in the area of "incubation" of thought is scarce.

Postman and Bruner, investigating the operation of perception under stressful conditions, found that categorizing or identifying behavior varies from behavior under normal perceptual conditions. In their experiments, when the completion of categorizing was blocked by the introduction of almost impossible viewing conditions, "reckless" identification behavior was produced on subsequent opportunities for perceiving. It is described as "reckless" because abortive identification occurred in the absence of adequate cues.⁸

Wyatt and Campbell studying similar situations found that the result is

⁷Heidebreder, E., "An Experimental Study of Thinking", Archives of Psychology, 1924, no. 73.

⁸Postman, L., and Bruner, J., "Perception Under Stress," Psychological Review, LV, 1948, 314-323.

to "saddle" the perceiver with an inappropriate categorization which must then be disconfirmed by subsequent stimulation before "correct" recognition can occur.⁹

In this respect, Allport's postulation of "directive state" theories of cognition was one means of stimulating research on the relationship between need-states and perceptual selectivity.¹⁰ Thus, as a related phenomenon we find that scarcely any theory of personality today of any significance whatever proceeds without explicit reference to and dependence on psychological concepts of perception.

Studies at McGill University have been conducted to discover the consequence of perceptual deprivation. They systematically studied the "placing" need deprivation, barring Subjects from perception of the normally rich world of objects. This condition appeared to have the effect of disrupting the smooth, ordered flow of cognitive activities which are normally present in problem solving. It is suggested that the condition may have the effect of disrupting even normal constancy processes basic to the perception and recognition of objects.¹¹

Climaxing his many previous studies of thinking, Bruner, in conjunction with Goodnow and Austin, has published the outcome of their extensive Harvard

⁹Wyatt, D., and Campbell, D. T., "On The Liability of Stereotype or Hypothesis", Journal of Abnormal and Social Psychology, XL, 1951, 496-500.

¹⁰Allport, F. H., Theories of Perception and the Concept of Structure, New York, Wiley, 1955.

¹¹Bexton, W. H., Heron, W., Scott, T., "Effects of Decreased Variation in the Sensory Environment", Canadian Journal of Psychology, VIII, 1954, 70-76.

research program, "a theoretical and experimental analysis of inference and thinking." They maintain that in concept attainment behavior certain conditions have not been adequately investigated: we must ascertain whether a person is or isn't consciously seeking to attain a concept, the nature of the concepts he must deal with, and whether he is "set" to do the tasks given him. Goldstein suggests that people are differentially set to handle the events they encounter: some seek constantly to form conceptual groupings, others to deal with events concretely in terms of simple identity categories. Moreover, we must also work with the person's expectancies concerning the nature of the concept with which he must deal. This involves cultural and subcultural factors and opens the way for far-reaching investigations and speculation.¹²

Bruner and his collaborators also suggest that the "two man game" feature in most of our experimental research on the thought processes might have consequences we should explore: the Subject in an experiment tends to define the task as one in which his abilities are under test. Therefore, an "error" may come to mean something different from and more severe than the consequences prevailing in more private cognitive activity. The effect may be to lead the Subject to play safe in his choice of a hypothesis or in the instances he chooses for testing. One countervailing factor may be to make such a hedgehog strategy less attractive. The Subject in approaching a task

¹² Bruner, J., Goodnow, F., Austin, G., op. cit., 59.

may also operate on the assumption that the Experimenter would not have chosen an easy task for testing his abilities. So one finds Subjects trying complicated approaches when easy ones would have served them better, and admitting it sheepishly after they discover that the task was simpler than they thought. They conclude that all factors that have to do with setting the level of aspiration, situational and personal, will in some measure affect the definition of a task and in so doing will affect the objectives that go into the forming of a behavior strategy.

Bruner in another study conceives that categorizing an event as a member of a class and giving it identity involves basically an act of inference, but also the right inference. "The more basic the confirmation of a hypothesis to the carrying out of a goal striving activity, the greater will be its strength. It will be more readily aroused, more easily confirmed, less readily infirmed.¹³

Hanfmann and Kasanin state that the very core of conceptual thinking is the "categorical attitude" as termed by Gelb and Goldstein. They state that this consists in our setting and of our viewing the experimental objects not as individuals, but as bearers of certain general characteristics, representative of certain categories such as color or shape. Thus, a Subject who has this attitude will, if he uses for example color as a basis of classification, exclude all objects of a different color regardless of all other

¹³ Bruner, J., "Personality Dynamics and the Process of Perceiving", in Perception: Approach to Personality, R. R. Blake and G. V. Ramsey (ED), New York, Ronald Press, 1951, 121-147.

similarities or dissimilarities.

They also suggest a second aspect of conceptual thinking, that of insight into the multiple probabilities of the choice, or into the arbitrariness of the class. The Subject, as they describe his activity, realizes he does not know the basis of the classification; that his task consists precisely in finding it by trying different possibilities, and that any characteristic applicable...may be the one sought.

A third aspect, which they believe to be the highest stage in the development of conceptual thinking, is the consideration of the total system by the Subject. It prompts him to test every general characteristic to see whether or not it will yield classes (as in their particular test) and keeps him from establishing groups based on different principles and therefore not mutually exclusive.

Their fourth factor, arising from the very nature of their test, is the actual classification based not on one but two characteristics which in their combination yield the subclasses. This requirement to combine two characteristics to form a new and less easily defined one is what is meant when the test is described as a "concept formation test". This factor seems to represent a considerable restriction of the possibilities of one type of non-conceptual solutions. Concepts to be found are not supported by already existing simple names which the Subject may have ready at hand.¹⁴

¹⁴Hanfmann, E., and Kasanin, J., "A Method for the Study of Concept Formation," Journal of Psychology, III, 1937, 521-540.

In a similar vein, Chant conducted an objective experiment on reasoning and concluded that there are two well defined methods of reasoning exemplified in his study, the first, the interpretative, where answers are derived from previously established associations, that are remote from the experimental setting itself. The second is the analytical wherein answers are derived by comparing cards or cards and answers (as in his experimental design).¹⁵ Thus, within the experimental setting the first seems to be the more basic or elementary type, while the second, the analytical, appears to be largely a product of training. This is basically in agreement with Heidbreder's earliest study which emphasized the difference between two kinds of behavior on the part of the "thinker": participant behavior wherein the person actively tests his hypothesis, and spectator behavior, wherein the person performs no obvious activity but is perhaps "waiting thoughtfully", often prior to the production of a successful hypothesis. The actual sequence of the occurrence of these two acts of cognitive behavior is not firmly agreed upon. It has been suggested that the participant phase may have to wait for the latter, that the two phases cannot be done simultaneously.

Chant further suggests that the analytical phase is that process which, by establishing relationships within the experimental setting itself, is representative of that type of inference which is characteristic of Mills' Canons of Induction.

¹⁵ Chant, S.N.F., "An Objective Experiment on Reasoning", American Journal of Psychology, XLV, 1933, 290.

Allport contends that there is a basic feature of perception which though often approached has never been satisfactorily nor fully explained, nor considered in sufficient detail by any of the theorists: the process whereby one perceives the concrete character of objects and situations, the meaning that one experiences with respect to one's world. Whereas percepts almost always contain an awareness of the identity and characteristics of what we are perceiving, a meaning accompanying the bare sensory experience, they frequently suggest a continuity with our past experiences, interjecting a sense or quality of familiarity. We are continuously supplementing these sensory or abstract features of what the thing is that we are perceiving. Allport suggests that the Gestalt theories seem to fit the situation very well, but he believes the total answer to the riddle is not to be found there.¹⁶

Goldstein and Scheerer cite numerous investigations about behavior changes in abnormals regarding the question of impairment of "abstract behavior". Gelb and Goldstein developed a number of methods for determining the capacity of brain-injured patients to do color-sorting tasks. Their behavior was analyzed and changes in their performance made possible a real distinction between concrete and abstract behavior. They conclude that normal persons are capable of both, whereas the abnormal is confined to only one type, the concrete. Abstract and concrete behavior they state, are

¹⁶Allport, F., op. cit., 531.

dependent on two corresponding attitudes psychologically so basic that they may be regarded as capacity levels of the total personality. They describe the concrete attitude as realistic, not implying conscious activity in the sense of reasoning, awareness, or self-account of one's activity.¹⁷

They list the findings of their study as follows:

- a. Some Subjects, adults or children, are able to acquire correct conceptualized responses, but they are unable to verbalize the underlying principles of the generalization;
- b. concepts may not necessarily be conscious;
- c. the formation of the concept is not usually an end in itself, but, in agreement with Hull's idea, it has always been a means to an end.¹⁸

One of the outcomes of attempts to categorize people as regards their ability to do abstract thinking, arrive at generalizations, and derive concepts, is the interpretation of this tested ability in terms of verbal ability or set. Studies of set are more germane to our purpose since set includes, in addition to a willingness to cooperate, more subtle factors of a social nature which greatly affect conceptualization, self-criticism,

¹⁷

Goldstein, K., and Scheerer, M., "Abstract and Concrete Behavior, An Experimental Study with Special Tests", Psychological Monographs, no. 239, 1941, 1.

¹⁸

Ibid., 1-3.

readiness to communicate. For all of these activities norms of rational behavior have been posited. In studies with children and psychiatric patients, however, we find that we cannot apply these norms, nor can we assume that these Subjects can maintain a set long enough to perform the required test items and report them. Hence, there has been an effort to find the qualitative differences between normals and abnormals regarding conceptualization or abstract thinking.

Among these is Hunt and Cofer's study which indicates that the pathology of thought in schizophrenia is largely one of difficulty in maintaining a¹⁹ set.

Several of the studies which have appeared since World War II have had as their main area of interest set or rigidity of thinking as it is seen operating in normal persons. While a good deal of mild controversy seems to be lingering in psychology about the specificity, propriety, and meaningfulness of the term as used, set as a concept is one we must continue to work with while the semantic battle continues. Woodworth called it "situation-and-goal-set".²⁰ We shall for our purposes here define it as a readiness to make a specified response to a specified stimulus. In man, set may be thought of as being unified and continuous, for, although he is affected continuously by innumerable things in his environment, his behavior is nonetheless integrated. He is capable of manipulating his environment,

¹⁹Hunt, J. McV., and Cofer, C. N., "Psychological Deficit", in Personality and The Behavior Disorders, ed. J. McV. Hunt, New York, Ronald Press, 1944, 1016.

²⁰Woodworth, R., "Situation and Goal Set", American Journal of Psychology, L, 1937, 130-140.

establishing motives, being selective in his perceptions, and integrating his behavior despite changes in himself and his environment. In the experimental situation we explore his behavior for short periods of time with regard to the above listed characteristics of his behavior, but with particular reference to what we call in experimental terminology "set". When we say that a person has a "readiness", we imply that his stimulus-response coordination is prepared in advance of any action he may engage in: when the stimulus is perceived, his response will follow. The Subject is prepared to select from the several environmental stimuli, a particular one or ones. Thus, in its selectivity set implies a need for the person to rule out, neglect, or inhibit all other possible stimuli and responses.

By way of a brief overview, it had been suggested by the Wurzburg school that the sequence was: first, the setting of the task, then the giving of instructions by the experimenter, and, through a conscious acceptance of these, development of a task attitude by the Subject. There was also believed to develop the operation of a selective mental trend or "determining tendencies" which governed the train of conscious content or response differently than was postulated by the routine laws of association.

Kulpe and Bryan experimented further to determine the effect of set on perception in an experiment which was thought to involve the process of "abstraction". The results suggested that attributes are all that occur in the mind at a given moment, that perceptions with different attributes result from different instructions to the Subject. In summing it up Allport states that "the stream of perception broadens...it now includes a predetermining,

dynamic component, the attitude of the Subject."²¹

Allport seems in agreement with Johnson when he discusses the relationship between motivation and set. He suggests that "a coercive stimulus (e.g. hunger) may provide an energetic upset in the organism that must be brought into equilibrium. These can break through existing sets and bring about a condition in which the organism frequently acts with a minimum of preparation. They may also lead later to the establishment of sets of their own. Motivation, in other words, may be a factor that lies behind set."²²

Johnson puts it that "in any workable system of concepts set must function at an intermediate level of integration, between the overall motivational pattern and the specific little acts," and he allows for much variation among sets.²³

Guetzkow analyzed the operation of set in problem solving with particular reference to it as a limiting variable of behavior. He found that there is a susceptibility to set as well as an ability to overcome set; that men and women are equally susceptible to set although men are significantly more able to overcome it. As a secondary task he studied three types of solutions assumed to be reproductive, or habitual, with a fourth presumably indicating productive thought. He found no sex differences in stereotypy but some evidence that men gave more nonhabitual or productive solutions than women.

²¹ Allport, F., op. cit., 84-85.

²² Ibid., 219.

²³ Johnson, op. cit., 66.

He also found that "nonsusceptibles" are able to give critical solutions to problems.²⁴

Thistlethwaite²⁵ found that performance on a nonsyllogistic test was affected by the subject matter of the test, anti-negro prejudice. These findings support those of Watson, who, in measuring fairmindedness by means of an "inference test", sagely concluded that "persons who have supposed that human beings when presented with the 'facts in the case' would be led by those facts to a rational and united conclusion have been abruptly disillusioned if they have made any attempt to verify this with a group of varied background and opinion".²⁶

Duncker, seeking to discover how the solution arises from the problem situation, worked with college and university students, giving them various thinking problems, asking them to think aloud, not introspect. He concluded that the solution properties found at first, the "functional values", always serve as a productive reformulation of the original problem, and that therefore, what is really done in any solution of problems consists in formulating the problem more productively. In commenting on the experimental aspects of the "functional fixedness of solution objects", he regards these as factors other than personality, which make for the operation of one concept rather

²⁴ Guetskow, H., "An Analysis of the Operation of Set in Problem Solving Behavior", Journal of General Psychology, XLV, 1951, 219-244.

²⁵ Thistlewaite, D., "Attitude and Structure as Factors in the Distortion of Reasoning", Journal of Abnormal and Social Psychology, XLV, 1950, 442-458.

²⁶ Watson, G. B., The Measurement of Fairmindedness, New York, Teachers College, Columbia University Press, 1925, 143.

than another in the same individual. He shows how under certain conditions once an object has been operated on by a certain concept, it is more difficult for a different concept to operate on that particular object. Citing conditions pertaining in racial or ethnic prejudices, he illustrates how the perception of an individual as a member of a certain group reduced the number or strength of cues or information necessary to trigger the operation of concepts associated with that group.²⁷

Rokeach worked with the aspect of flexibility in shifting attack on a problem. His study proceeded from existing knowledge of authoritarianism and ethnocentric people, and was based on the hypothesis that people scoring high on ethnocentrism would in all likelihood be more rigid in problem solving situations than low scorers, since "flexibility" and "rigidity" can refer to personality as well as to intellectual traits. He found this to be true: in testing 35 college students who scored high on an ethnocentrism test and 35 who did not, the highly ethnocentric students solved 2.2 Luchins jar problems in a rigid way whereas the less ethnocentric group solved 1.4 problems rigidly. The difference though small was significant.²⁸

Schroeder and Rotter experimentally created rigidity of a different degree which would differentially affect performance in a problem solving task. They regard rigidity not as a trait or an entity but as a kind of

²⁷ Duncker, op. cit., 8-9.

²⁸ Rokeach, M., "The Effect of Perception Time Upon Rigidity and Concreteness of Thinking", Journal of Experimental Psychology, XL, 1950, 206-216.

behavior which can be predicted from specific learning experiences. Rigidity now seems to be a fairly general source of individual differences in performing certain kinds of tasks, particularly those involving reasoning.²⁹

Research on individual differences in reasoning has been carried on principally by means of studies in factor analysis. Burt in a study with school children stated that the syllogism was the best single test of general intelligence.³⁰ This is in agreement with Spearman who has long maintained that "G", the general factor found in tests of intelligence functions may be considered the eduction of relations and correlations. Thurstone applied the multiple factor method to the analysis of the correlations between 57 tests taken by 250 college students, and the factor called "induction" was identified. It was best tested by the number series test, which renders it significant for our purposes. Two other factors not clearly outlined were restrictive thinking or reasoning, and deduction.³¹

It is thus possible to trace the extensive use of the inductive and deductive forms of inference as means of testing reasoning ability. Although the preceding studies have purported to show the various ways in which

²⁹Schroeder, H. M., and Rotter, J. B., "Rigidity as Learned Behavior", Journal of Experimental Psychology, XLIV, 1952, 141-150.

³⁰Burt, C., "The Development of Reasoning in School Children", Journal of Experimental Pedagogy, V, 1919, 68-77, 121-127.

³¹Thurstone, L. L., "Primary Mental Abilities", Psychometric Monograph, No. 1, Chicago, Chicago University Press, 1938.

cognition, perception, and personality are regarded as separate entities and also their interrelatedness, there has been little or no reference to the different kinds of reasoning that man uses in his daily life. The following studies are exclusively of that kind and are in consequence of particular importance for this study.

Burt, in his study cited above, investigating the development of reasoning in school children, found that the ability to reason syllogistically exists at primary school age levels though it is not strictly the logistical form. Contrary to the way in which a student of logic would solve such a problem as a syllogism by recalling previous similar problems, and reaching a conclusion without much thought, children must attack it differently. Many "thinkers" report that they do not seek a conclusion directly, but first try to arrange the data into a pattern from which they then read off the desired conclusion. The data in the syllogisms were in order, but in solving them, some dispositions of the data were easier to arrange than others, requiring reversal or conversion. These processes take a little effort, and a problem requiring a conversion is more difficult than one wherein the relationships are given in a more straight-forward form.³²

Wilkins found that familiarity in the terms of the written syllogism renders them easier for college students than syllogisms written in unfamiliar terms but in the same logical form.³³

³² Burt, op. cit., 121-127.

³³ Wilkins, M. C., "The Effect of Changed Material on Ability to Do Formal Syllogistic Reasoning", Archives of Psychology, 1928.

Holzinger and Harman have not confirmed the separation of inductive and deductive reasoning.³⁴ In another investigation factor analysis by the bifactor method of tests of reasoning, deduction, problem-solving and the like along with other kinds of tests failed to show a group factor of reasoning at all. Tests of thinking, on the contrary, had high loadings on the general factor. The investigators therefore concluded that the general factor consists largely of reasoning ability. This is in agreement with Spearman's claim that ability to handle abstract relations is at the center of intelligence.³⁵

It is pertinent at this point to consider Johnson's observation about the strictly inductive and strictly deductive processes as such. "Forming concepts, principles, and patterns of personality traits may be called inductive tasks in that the particulars are organized into patterns. But we do not observe these cognitive patterns directly: we test for the pattern by asking the thinker to use it in some particular way, that is, by a deductive process. And in reverse, problems that are called deductive, e.g., the syllogism, always include an inductive step because the particulars of any problem have to be organized before any conclusions can be produced. It should be possible to invent an objective method for classifying logical problems as predominantly inductive or predominantly deductive in respect to the principal

³⁴Holzinger, K. J., and Harman, H. H., "Comparison of Two Factor Analyses", Psychometrika, III, 1938, 45-60.

³⁵Holzinger, K. J., and Swineford, F., A Study in Factor Analysis: The Stability of a Bi-Factor Solution, University of Chicago, Supplement to Educational Monographs, No. 48, 1939.

source of difficulty. The application of a factor analysis...has not been completely successful. At present the distinction between inductive and deductive problems is made by subjective or logical examination and really cannot be taken very seriously. Some psychologists call all such problems reasoning problems. Some logical problems-and these might plausibly be called deductive-require the discovery of logical relations or the rearrangement of logical patterns in such a way that a conclusion can be attained or a question answered."³⁶

Undeterred, at any rate until Johnson or someone stimulated by his comments comes forth with such an "invention", psychologists continue their studies into the nature of the reasoning processes, and the characteristics of "good" as opposed to "poor" reasoners. McNemar in attempting to seek out this distinguishing feature found that "good" reasoners were better able to overcome an experimentally-induced set and were superior on Thurstone's test of Deduction.³⁷

Burack tested 22 undergraduate students in psychology, using tests of induction, deduction, and unicursal figure problems. Their performance was analyzed in terms of the use of nine different methods of attack of the problems. He found that the extent of use and the potential efficacy of a particular method of attack varied with the kind of problem involved. Moreover, the function that caused difficulty in one problem might be very easy

³⁶ Johnson, op. cit., 244.

³⁷ McNemar, O. W., "An Attempt to Differentiate Between Individuals with High and Low Reasoning Ability", American Journal of Psychology, LXVIII, 1955, 20-36.

in another; and, conversely. He also discovered that in some cases the formulation of the problem was so obvious that there was no difficulty at this point in any problem.³⁸

Blakey made a factor analysis of non-verbal reasoning tests, seeking to find whether a reasoning factor could be found in this type of test. Although the tests were printed on paper and the instructions were given verbally, the tests items consisted of forms for comparison, circles to be marked according to a system, and other objects to be classified and treated following abstract rules. He concluded that verbal and nonverbal reasoning have much in common. He rejected "deduction" as a concept, believing that the subject does not have to make his own deductions, but has merely to choose from those given. He did list in his findings, however, that with regard to the deduction and induction test findings, within the limitations of the particular tests used to measure these processes, verbal and non-verbal reasoning have much in common.³⁹

In the studies thus far mentioned the underlying assumption has been that the syllogism as such exemplifies deductive thinking without qualification. Woodworth states that the syllogism expressed in letter symbols, whereby extraneous associations are reduced to a minimum, is a useful device

³⁸ Burack, B., "The Nature and Efficacy of Methods of Attack on Reasoning Problems," Psychological Monograph, 64, np. 313, 1950.

³⁹ Blakey, R. I., "A Factor Analysis of Non-Verbal Reasoning Tests", Educational & Psychological Measurement, II, 1941, 187-198.

for analyzing thought processes to a greater degree than can some test items.⁴⁰

Melzer reports his study where the training given to students in a first course in Formal Logic had the effect of raising the IQ sufficiently to merit inquiry into the advisability of making this subject a college requirement rather than an elective.⁴¹

Thorndike in an early study about changing data and its effect on reasoning concluded that "any disturbance whatsoever in the concrete particular reasoned about will interfere somewhat with the reasoning making it less correct, or slower, or both."⁴² Citing these results as indicating the importance of habit in reasoning, he also defined reasoning as "the organization and cooperation of habits." His results are in agreement with Wilkins' wherein he concludes that the ability to do syllogistic reasoning is much affected by a change in the material reasoned about. He found that the easiest material is the familiar and concrete; that the most difficult is the unfamiliar (long words). Symbollic material is almost as difficult as the unfamiliar, and suggestive material is more difficult than the unfamiliar but not so difficult as the symbollic. He states, too, that there is a marked but not too high correlation between success on the syllogistic test

⁴⁰ Woodworth, op. cit., 807.

⁴¹ Melzer, J. H., "Functional Logic", Journal of Higher Education, XI, 1946.

⁴² Thorndike, E., "Effects of Changed Data on Reasoning", Journal of Experimental Psychology, 1922.

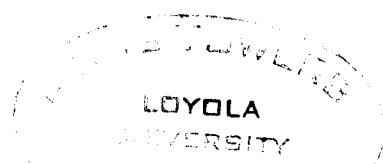
he used and success on the Thorndike Intelligence Examination.⁴³

In 1946 Lefford undertook to analyze some of the factors which deleteriously influenced logical thinking. His study chiefly demonstrated the effects of verbal stereotypes on syllogistic reasoning, and how attitudes and the factor of set may be modified by this behavior. He administered forty syllogisms to two groups of college students. Each of the groups of syllogisms was of the same form and relative difficulty although one group of twenty concerned controversial issues and the other group non-controversial. The students were asked to judge whether the conclusions arrived at in the passages were warranted by the statements given in support of them. Scores on the controversial-content syllogisms were low. The twenty non-controversial-content syllogisms were judged correctly much more frequently than the preceding group. It would appear from this that although the subjects were set for abstract judgments, they could nonetheless not help making affective judgments. It was also discovered in this study that the order of presentation of the two groups had an effect on the scores of the subjects: solving emotionally toned syllogisms first had a deleterious affect on the results of the subsequent solution of the neutrally toned ones.⁴⁴

This is in agreement with the findings of Woodworth and Sells who guessed that the judgment of the conclusion of a syllogism depends on the impression or atmosphere created by the premises as well as by the logical

⁴³Wilkins, op. cit., 27.

⁴⁴Lefford, A., "The Influence of Emotional Subject Matter on Logical Reasoning", Journal of General Psychology, XXXIV, 1946, 127-151.



relations of the premises. Negative premises set up a negative atmosphere; affirmative premises set up an affirmative atmosphere and the conclusions in agreement with the atmosphere thus engendered are likely to be accepted. The Subjects' response to the set was adequate but they were attending to the wrong aspects of the stimulus material, to the atmosphere of the premise rather than to logical relationships.⁴⁵

In a similar vein Janis and Frick used syllogisms to test the influence of affective involvement on abstract judgment. Graduate students with no formal training in logical analysis were given sixteen syllogisms. They had two alternate conclusions to choose from. Their judgments could be of four types: agree-valid; disagree-invalid; agree-invalid; disagree-valid. The effect of the attitude could be expected to cause the Subjects to judge the conclusion valid when they agreed with it, and to judge it invalid when they disagreed with it. Scorewise, this would increase the proportion of judgments in the first two of the above categories, and decrease the proportion of scores in the last two categories. Even though the Subjects had only two alternatives to choose from, they were wrong on 23% of the items. There was a preponderance of items in the agree-valid and disagree-invalid categories.⁴⁶

⁴⁵ Woodworth, R. S., and Sells, S. B., "An Atmosphere Effect in Formal Syllogistic Reasoning", Journal of Experimental Psychology, 1935, 451-460.

⁴⁶ Janis, I. L., and Frick, F., "The Relationship Between Attitudes Toward Conclusions and Errors in Judging Logical Validity of Syllogisms", Journal of Experimental Psychology, 1943, 73-77.

One of the more comprehensive studies of reasoning reported, proceeding from an interest in factor analysis, is that undertaken by Guilford and his associates at the University of Southern California. They posited the supposition that the general reasoning ability might be the ability to manipulate symbols, to solve problems, to define, formulate, or structure given problems, to test hypotheses, to organize a sequence of logical operations. A second reasoning ability might be induction. They further hypothesized about induction that it is the ability to group a system of relationships in its totality, or that it is an ability to see trends in a series of objects, or a closure factor common to perceptual and symbolic material. Other hypotheses were listed also. To test these, 34 tests were used, most of which were based on these hypotheses while others tested well-known reference factors, such as number facility and verbal comprehension.

The battery of tests was given to two military samples, 283 selected for special training on the basis of intelligence test and educational requirements. The most important factor identified was the general reasoning factor: a broad factor in which reasoning about arithmetic problems was the chief defining variable. Reasoning about spatial or perceptual material was also strongly represented. Reasoning of a deductive nature, as in syllogisms, was absent.

A second reasoning factor was identified in a variety of tests, chiefly in tests of deductive reasoning, inferences, syllogisms, and false premises. About this second factor the investigators state reminiscent of Blakey cited above, that "presumably the chief process in deductive reasoning is the drawing of inferences or conclusions. But note that the tests which have

been used to define the so-called deductive factor have been of the multiple-choice or true-false form. The examinee does not have to draw his own conclusion. Conclusions are given to him and what he must do is to decide which one is correct. Deciding about the correctness of a conclusion is a different process than producing the conclusion. It is an act of judgment or evaluation. The criterion of evaluation in these tests is that of logical necessity. We might describe this factor as a sensitivity to logical necessity. The name we have chosen, "logical reasoning", is of broader connotation to allow for other and possibly more exact descriptions. It remains to be seen whether deduction tests in the form of completion items will give a rise to an additional separate factor from this one. ... Perhaps the most interesting outcome was that tests of syllogisms and the like, which have been considered typical of reasoning, are not prominent in the general reasoning factor. Instead they form a factor by themselves which is not called deduction,... but logical reasoning."⁴⁷

CHAPTER III

PROCEDURE

The subjects who participated in this study are one hundred male students at a large technical high school in Chicago, and one hundred adult students in the evening division of one of the large universities in the city. The majority of the latter group are graduate students. Of the total of one hundred adults, twenty are women. The age difference between the two groups is a four-year span at the upper limits of the high school group and the lower limits of the adult group. Since it was decided as a secondary hypothesis to test the age differential with respect to deductive reasoning ability the maintenance of this age gap was one of the factors which to some extent determined the selection of the sample groups tested.

The high school group consists of adolescent boys who are in an "honor" group with respect to their scholastic standing in school. The professed interest and enthusiasm of the great majority of the group is science, and their course programs are said to comprise electives in this field almost exclusively. Ninety-eight of the young men are in fourth year high school, 69 in the first semester of the fourth year, and 29 in the last semester of the fourth year. The two other students are in third year, one in the first and one in the second semester, and take many classes with the older group because of their high level of ability and generally fine scholastic achievements.

The adult group consists of seventy-one students who are attending graduate school in the evening division of a university. They are majoring in one or another phase of industrial relations, and are employed in business during the day. Only one of this group is a woman. The other twenty-three subjects are enrolled in a class in psychology in the evening division of the university. Twelve of them are completing their undergraduate college work and seventeen have completed college work and are continuing to attend classes either as graduate students or as special students. They are employed during the day, and are students who are working in the field of education.

Each of the two groups was given three pencil and paper tests, group administered, at one sitting. The high school group was tested at one time, as a large group of one hundred. The adult group was tested as five smaller sub-groups of fifteen - thirty subjects in each. All of the testing was done by the experimenter.

Deductive reasoning ability was tested by the Eggert Test of Syllogistic Reasoning. This is a timed test consisting of thirty syllogisms, the conclusions of which are to be checked as True or False. The score is the number of correct answers.

Inductive reasoning was tested by the Loyola Induction Study, a number completion test of sixty-two items, patterned after Test Six of the Army Alpha. For purposes of this study it did not seem that the discrimination between inductive and deductive reasoning need be determined by fully standardized tests. The one test is purely syllogistic reasoning, universally recognized as a deductive process. The other is a liberal extension of a subtest of the Army Alpha; it is entirely involved with discovering and

generalizing from particulars, the typical description of the inductive process. Both of these instruments show fairly consistent increments of scores at different age levels.

Adjustment was tested by the California Test of Personality, Adult, Form AA. This considers life adjustment in terms of the balance between personal and social adjustment. The test is scored by counting the number of correct answers. An item is answered correctly when all of the three missing numbers in the series are correctly given. The test is divided into two sections, one of ninety items designed to measure personal security in terms of six components: self-reliance, sense of personal worth, sense of personal freedom, feeling of belonging, freedom from withdrawing tendencies, and freedom from nervous symptoms. The second section also consists of ninety items, these having to do with social adjustment in terms of social standards, social skills, freedom from anti-social tendencies, family relations, occupational relations, and community relations. The test has been widely and successfully used both in school and industrial counseling and placement programs. Because it provides measures of adjustment in a number of defined and quantifiable areas, it seemed to be well suited to the purpose of the study. Raw scores of the number of "right" answers were used in the analysis of the data, and total adjustment scores were used, i.e., the sum of Personal Adjustment and Social Adjustment scores.

CHAPTER IV

ANALYSIS OF THE DATA

Mean scores, standard deviations, and differences are listed for both groups in Table I.

Table I
MEANS, SD's, AND DIFFERENCES FOR TWO GROUPS ON TESTS
OF REASONING AND ADJUSTMENT

TEST	MEAN		SD		DIFFERENCE	
	Adult	HS	Adult	HS	F	t_m
Loyola Induction Study	37.62	45.62	12.57	9.22	1.858*	5.127*
Eggert Syllogistic Reasoning	12.48	16.37	5.07	5.41	1.134	5.241*
California Test of Personality	146.24	131.15	18.21	20.96	1.326	5.433

* = $P < .01$

The range of scores for both groups on tests of the thought processes is:

TEST	GROUP	RANGE
Loyola Induction Study	Adult	1-60
	HS	27-62

(Cont'd.)

TEST	GROUP	RANGE
Eggert Syllogistic Reasoning	Adult	0-28
	HS	3-30

That the high school group scored higher than the adult group on both of these tests may be explained by the fact that both induction and deduction are closely related to intelligence, and, since the high school group is said to be very bright, it is to be expected that they would achieve high scores on these two tests. Moreover, it would appear that there is operating in the adult group the phenomenon demonstrated by Weschler and others that adult scores on intelligence tests tend to decrease in number of points with increasing age, indicating a decline of mental ability. Despite this decrease in terms of actual point measures and in actual intellectual ability as such, experience and wisdom or practical ability may often replace the intellectual acumen that has been lost through what Weschler describes as "a falling off of native ability."

Scores for both groups on the California Test of Personality shown in Table 1 indicate a high degree of adjustment for both groups, and compare favorably with norms published by the authors of the test. The range of scores for both groups is:

Adult	95-173
HS	49-171

Using a Pearson product moment correlation formula,

$$\frac{N\sum XY - \sum X \sum Y}{\sqrt{N\sum X^2 - (\sum X)^2} \sqrt{N\sum Y^2 - (\sum Y)^2}}$$

to measure the relationship between induction and deduction, the following coefficients were derived:

Factors	Group		Difference
Induction-Deduction	Adult	HS	t_r
	.343	.125	1.623

From this it is apparent that induction and deduction are two separate mental abilities as measured by the tests used in this study. That the relationship is positive may be explained by the fact that they are both aspects of a common general ability, intelligence, as reported in some of the basic research cited in Chapters I and II. That induction correlates less with deduction in the younger group than in the adult group may be explained in this way: Deduction as measured in tests of intelligence is recognized as an ability which develops with increasing age, possibly reaching a peak at about twenty years. Hence it is not surprising that in the younger group experience rather than high level reasoning is the means by which they arrive at solutions to their problems. This lower correlation, however, is not a contradiction of the fact that they achieved high scores on the two reasoning tests: since induction and deduction are closely related to intelligence we may expect that when younger subjects are tested on these abilities their scores will be widely scattered as is the case when intelligence test scores are plotted for younger subjects. While there is a real tendency for this scatter among scores of younger subjects, scores on intelligence tests for adults tend to cluster and to be less widely dispersed. The findings of this phase of this study may be interpreted in the light of Anastasi and Foley's

study wherein they thoroughly investigated and present for comparison the theories and supporting research about the growth and decline of intelligence.¹

With regard to the relationship of these factors in the adult group, it is possible that the greater relationship expressed by the larger coefficient is descriptive of the fact that it is difficult to separate induction from deduction in the full and complete sense; that, as Johnson has suggested, in every deduction there is an element of induction and vice versa: "we test for the cognitive pattern by asking the subject to use it in a particular way, by the deductive process. In reverse, problems that are called syllogisms always include an inductive step because the particulars of any problem have to be organized before any conclusions can be produced".² It is possible that the relationship of these two thought processes in the adult group is greater because the mature, normal, stable adult is said to be one who is capable of solving problems through the utilization both of his experience and of his higher reasoning faculties. At any rate, because of what is already known through factor analysis studies of intelligence, it seems reasonable to interpret the higher correlation in the adult group as being the result of greater maturity and age rather than as low validity of the reasoning tests when used at higher age levels.

¹ Anastasi, Anne, and Foley, John P., Jr., Differential Psychology, Revised Edition, New York, MacMillan Company, 1949.

² Johnson, op. cit.

Proceeding from this analysis it should be possible to analyze the relationship of these two separate thought processes as they relate to personal adjustment, the major purpose of this study.

Correlation of adjustment scores with induction are

Adult	.081
HS	.037
Difference	
t_r	.280

It would appear from this that both groups are using experience as a means of solving problems, arriving at a satisfactory adjustment in life so far, though neither of the coefficients is significant.

Correlations computed for scores on deduction and adjustment yielded these coefficients:

Adult	.229
HS	.058
Difference	
t_r	1.212

These show a more significant relationship for both groups than induction and adjustment. In the case of the older group, it would seem to indicate that normal adults in problem solving situations are more apt to reason toward solutions, using experience to a lesser degree. The high school subjects, however, seem to be using experience in problem solving situations, although its relationship to adjustment for this group is not significant.

These data can also be interpreted as indicating that deduction is more closely related to good adjustment than induction which showed relatively low correlations with adjustment for both the adult and high school subjects. It also illustrates the contention of many research workers in psychiatry that the normal person is more likely to show resiliency in his use of his higher mental powers than is one who is seriously disturbed. Where there is good adjustment normal adults seem more able and more inclined to reason to solutions to problems, which is, after all, one of the desirable goals of self-knowledge and one of the outcomes of successful psychotherapy.

CHAPTER V

SUMMARY AND CONCLUSIONS

It was suspected that the two tests, the one predominantly of inductive ability, the other predominantly of deductive or speculative ability, would be related to adjustment in different ways. It was also hypothesized that these two phases of intelligence, inductions (or reasoning from a series of experiences like a number series) and deduction (or speculating about the conclusions of syllogisms on the basis of logical principles), would be used by children differently than by adults. Hence, the degree to which induction scores correlated with total adjustment would be different from the degree to which deduction scores correlated with total adjustment.

This hypothesis was confirmed in the case of adults but not of younger persons. The correlation between adult deduction and adjustment was .229, significant at the .05 level of confidence. The correlation for adult induction and adjustment was .081, not significant even at the .10 level of confidence. All of the correlations between adjustment and inductive or deductive ability of the high school group were statistically insignificant.

Thus, adults apparently differ from younger persons in the sense that for them the deductive processes at least seem to be more related to adjustment than are the inductive processes. However, the correlation is not high enough to justify prediction: it only indicates group trends.

The performance of both groups was analyzed by correlating the reasoning test scores with adjustment scores computed for each of the two major parts of the CTP, Personal Adjustment and Social Adjustment.

Correlations were also computed from adjustment scores derived from combining the scores of Sections 1A and 1B (Self-Reliance and Sense of Personal Worth); and scores of Sections 2A and 2B (Social Standards and Social Skills).

Table II shows the correlations between Deduction and the several adjustment scores for both groups.

Table II
CORRELATIONS BETWEEN DEDUCTION AND ADJUSTMENT
SCORES FOR TWO GROUPS

Group	Tests	r
Adult	Deduction and Total Adjustment	.229
	Deduction and Personal Adjustment	.111
	Deduction and Social Adjustment	.255
	Deduction and CTP, Sections 1A and 1B	.128
	Deduction and CTP, Sections 2A and 2B	.201
	(r. Induction and Deduction = .343)	
H.S.	Deduction and Total Adjustment	.058
	Deduction and Personal Adjustment	.046
	Deduction and Social Adjustment	.138
	Deduction and CTP, Sections 1A and 1B	-.016
	Deduction and CTP, Sections 2A and 2B	-.012
	(r. Induction and Deduction = .125)	

Table III shows the correlations between Induction and the several adjustment scores for both groups.

Table III
CORRELATIONS BETWEEN INDUCTION AND ADJUSTMENT
SCORES FOR TWO GROUPS

Group	Tests	r
Adult	Induction and Total Adjustment	.081
	Induction and Personal Adjustment	.101
	Induction and Social Adjustment	.063
	Induction and CTP, Sections 1A and 1B	.052
	Induction and CTP, Sections 2A and 2B	-.007
H.S.	Induction and Total Adjustment	.037
	Induction and Personal Adjustment	.062
	Induction and Social Adjustment	.007
	Induction and CTP, Sections 1A and 1B	.090
	Induction and CTP, Sections 2A and 2B	.087

From these data it is clear again that the only category of correlation approaching significance is that between adult deduction and some phases of adjustment. It seems that the items dealing with social adjustment have the strongest relationship to deduction. This correlation is significant at the .01 level of confidence.

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APPENDIX I

SPECIMEN TESTS

LOYOLA INDUCTION STUDY

Name _____ Date _____

Student at _____

Highest year of school completed (circle one)

6 7 8 9 10 11 12 13 14 15 16 _____

What is your favorite study or your major field? _____

INSTRUCTIONS

This is not an intelligence test. It is part of a study of how people make discoveries.

There are some easy examples below. Please read each row of figures and then write in the three blank spaces at the end of each row the numbers that should follow.

2	4	6	8	10	12	_____	_____	_____
9	8	7	6	5	4	_____	_____	_____
1	7	2	7	3	7	_____	_____	_____
2	2	3	3	4	4	_____	_____	_____

N.B. Please do not turn this page until you are told to do so.

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Adult

Form A

California Test of Personality

1953 Revision

Devised by

ERNEST W. TIEGS, WILLIS W. CLARK, AND LOUIS P. THORPE

Do not write or mark on this booklet unless told to do so by the examiner.

Name..... Occupation..... Sex.....
Last First Middle or Grade M-F

School or Date of
Organization..... City Test.....
Month Day Year

Examiner..... (.....) Examinee's Age..... Date of Birth.....
Month Day Year

INSTRUCTIONS TO EXAMINEES:

This booklet contains some questions which can be answered YES or NO. Your answers will show what you usually think, how you usually feel, or what you usually do about things. Work as fast as you can without making mistakes.

DO NOT TURN THIS PAGE UNTIL TOLD TO DO SO.

INSTRUCTIONS TO EXAMINEES

DO NOT WRITE OR MARK ON THIS TEST BOOKLET UNLESS TOLD TO DO SO BY THE EXAMINER.

You are to decide for each question whether the answer is YES or NO and mark it as you are told. The following are two sample questions:

SAMPLES

- A. Do you have a dog at home? YES NO
B. Can you drive a car? YES NO

DIRECTIONS FOR MARKING ANSWERS

ON ANSWER SHEETS

Make a heavy black mark under the word YES or NO, whichever shows your answer. If you have a dog at home but cannot drive a car, you would mark the answer sheet this way:

	YES	NO
A		
B		

Mark under the word that shows your answer.
Find answer row number 1 on your answer sheet.
Now wait until the examiner tells you to begin.

ON TEST BOOKLETS

Draw a circle around the word YES or NO, whichever shows your answer. If you have a dog at home, draw a circle around the word YES in Sample A above; if not, draw a circle around the word NO. Do it now.

If you can drive a car, draw a circle around the word YES in Sample B above; if not, draw a circle around the word NO. Do it now.

Now wait until the examiner tells you to begin.

After the examiner tells you to begin, go right on from one page to another until you have finished the test or are told to stop. Work as fast as you can without making mistakes. Now look at item 1 on page 3.

SECTION 1 A

1. Is it easy for you to turn down unreasonable requests? YES NO
2. Do you prefer competition of some kind to working alone? YES NO
3. Are you easily irritated when people argue with you? YES NO
4. Do you usually carry out your plans in spite of opposition? YES NO
5. Do you usually get upset when things go wrong? YES NO
6. Is it easy for you to introduce or be introduced to people? YES NO
7. Is it hard for you to go on with your work if you are not encouraged? YES NO
8. Are you willing to tell your friends when you strongly disapprove of their actions? YES NO
9. Is it hard for you to admit when you are wrong? YES NO
10. Is it easier to do things that your friends propose than to make your own plans? YES NO
11. Do you feel uncomfortable when you are alone with important people? YES NO
12. When you have a real grievance, do you usually see that it is settled? YES NO
13. Can you work alone as well as with others? YES NO
14. Do you feel at ease when talking to members of the opposite sex whom you do not know well? YES NO
15. Does it discourage you when people do not appreciate you? YES NO

GORIGHT ON TO
THE NEXT COLUMN

Section 1 A

(number right)

SECTION 1 B

16. Are you given adequate credit for your ability to deal with people successfully? YES NO
17. Do you feel that you are not very good at handling money? YES NO
18. Do you find it hard to get people to accept your ideas? YES NO
19. Do most of your friends have confidence in your ability? YES NO
20. Are you often invited to social affairs? YES NO
21. Do your superiors pay as much attention to you as you deserve? YES NO
22. Do you have opportunity to show your true ability? YES NO
23. Do people usually ask for your judgment in important matters? YES NO
24. Do people seem to enjoy having you as a guest or going places with you? YES NO
25. Do your friends seem to think that you have made the success of which you are capable? YES NO
26. Are you considered mediocre in many of the things you do? YES NO
27. Even when you show good judgment, do you often fail to receive proper credit? YES NO
28. Are you considered unusually capable or courageous? YES NO
29. Do most of your friends go out of their way to help you? YES NO
30. Do a number of people depend on you for advice and guidance? YES NO

GORIGHT ON TO
THE NEXT PAGE

Section 1 B

(number right)

SECTION 1 C

31. Do you have enough time for recreation? YES NO
32. Do you have to do what other people decide most of the time? YES NO
33. Do you have enough spending money? YES NO
34. Does your family object because you spend too much time with outside friends? YES NO
35. Are you prevented from managing your own work or career as you wish? YES NO
36. Do you feel that you can say what you believe about things? YES NO
37. Do you feel that you can do what you wish as often as your friends can? YES NO
38. Would you be happier if someone else did not have so much authority over you? YES NO
39. Are you at liberty to do about as you please during your spare time? YES NO
40. Does your family object to some of your close friends? YES NO
41. Are you usually prevented from attending the clubs or affairs that you like? YES NO
42. Do you have the opportunity to associate with your friends as much as you like? YES NO
43. Are you often criticized for things that do not amount to much? YES NO
44. Do your responsibilities keep you "tied down" too much? YES NO
45. Are you troubled by the fact that economic conditions restrict your freedom? YES NO

SECTION 1 D

46. Are you invited to groups in which both men and women are present? YES NO
47. Have you found it almost impossible to take your friends into your confidence? YES NO
48. Do you feel that your relatives are as attractive and successful as those of your friends? YES NO
49. Do your friends and acquaintances seem to have a better time in their homes than you do? YES NO
50. Have you been invited to join as many organizations as you deserve? YES NO
51. Have you often wished that you were a member of a different family or group? YES NO
52. Are you regarded as being as healthy and strong as most of your friends? YES NO
53. Do your friends seem to rate you as high socially as they should? YES NO
54. Have you found it difficult to make as many friends as you wish? YES NO
55. Are you liked well enough so that you feel secure socially? YES NO
56. Do you feel that you are an important member of some organization? YES NO
57. Do you have enough friends to make you feel happy? YES NO
58. Do your friends ask your advice as often as they should? YES NO
59. Have you often felt that some people were working against you? YES NO
60. Do you usually feel at ease when both men and women are present? YES NO

GO

RIGHT ON TO
THE NEXT COLUMN

Section 1 C
(number right)

GO

RIGHT ON TO
THE NEXT PAGE

Section 1 D
(number right)

SECTION 1 E

61. Are certain people so unreasonable that you hate them? YES NO
62. Do you find it more pleasant to think about desired successes than to work for them? YES NO
63. Do you find that many people seem perfectly willing to take advantage of you? YES NO
64. Do you have many financial problems that cause you a great deal of worry? YES NO
65. Do you find it hard to meet people at social affairs? YES NO
66. Are your responsibilities and problems often such that you cannot help but get discouraged? YES NO
67. Do you often feel lonesome even when you are with people? YES NO
68. Are conditions frequently so bad that you find it hard to keep from feeling depressed? YES NO
69. Do you prefer to be alone rather than to have close friendships with many of the people around you? YES NO
70. Would you rather stay away from parties and social affairs? YES NO
71. Do you find it difficult to overcome the feeling that you are inferior to others in many respects? YES NO
72. Do you generally go out of your way to avoid meeting someone you dislike? YES NO
73. Does it seem to you that younger people have an easier and more enjoyable life than you do? YES NO
74. Are you as a rule shy when in the presence of people you don't know? YES NO
75. Do you often feel depressed because you are not popular socially? YES NO

SECTION 1 F

76. Are you likely to stutter when you get worried or excited? YES NO
77. Do your muscles twitch some of the time? YES NO
78. Are conditions under which you live so bad that they frequently make you nervous? YES NO
79. Do you feel inclined to tremble when you are afraid? YES NO
80. Even though you can conceal it, do you frequently feel irritable? YES NO
81. Do you often suffer from annoying eye strain? YES NO
82. Is it hard for you to sit still? YES NO
83. Are you more restless than most people? YES NO
84. Are you frequently troubled by serious worries? YES NO
85. Do people frequently speak so indistinctly that you have to ask them to repeat their questions? YES NO
86. Do you frequently find that you have read several sentences without realizing what they are about? YES NO
87. Do you find that you are tired a great deal of the time? YES NO
88. Do you often have considerable difficulty in going to sleep? YES NO
89. Do you suffer from attacks of indigestion for which there is no apparent cause? YES NO
90. Do you have difficulty thinking clearly when you get worried or excited? YES NO

GO

RIGHT ON TO
THE NEXT COLUMN

Section 1 E

(number right)

GO

RIGHT ON TO
THE NEXT PAGE

Section 1 F

(number right)

SECTION 2 A

91. Are people sometimes justified in disobeying the law when it appears to be unfair? YES NO
92. Should one respect the personalities of all foreigners? YES NO
93. Is it necessary to be friendly to new neighbors? YES NO
94. Is it wrong to avoid responsibility or work if you are not required to do it? YES NO
95. Should one be courteous to people who are very disagreeable? YES NO
96. Should one be expected to fulfill a contract which he believes he should not have made? YES NO
97. Is it dishonest to fail to pay a railroad or bus fare if the opportunity presents itself? YES NO
98. Does finding an article give people the right to keep or sell it? YES NO
99. Are there times when it is justifiable to borrow other people's property without telling them? YES NO
100. Do people who persist in getting into trouble after proper warning deserve sympathy? YES NO
101. Is it right to humiliate publicly those who show disrespect for other people? YES NO
102. Should one always be more respectful to people of greater wealth? YES NO
103. Should a person be fair to disagreeable people? YES NO
104. Is it always necessary to return an article that has been found? YES NO
105. Are the beliefs of some people so absurd that one is justified in denouncing these beliefs? YES NO

SECTION 2 B

106. Do you find it easy to introduce people to each other? YES NO
107. Can you break away from a social gathering easily? YES NO
108. Is it easy for you to talk with people as soon as you meet them? YES NO
109. Is it hard for you to lead in enlivening a dull social affair? YES NO
110. Do you frequently find it necessary to interrupt a conversation? YES NO
111. Do you often go to some trouble in order to be with your friends? YES NO
112. Do you find it difficult to keep from offending people occasionally? YES NO
113. Do you often assist in planning social gatherings? YES NO
114. Do you habitually compliment people when they do something well? YES NO
115. Have you found that it does not pay to be too dependable? YES NO
116. Do you have many friends rather than just a few? YES NO
117. Do you attempt new games at social affairs even when you haven't played them before? YES NO
118. Do you contribute to campaigns intended to give assistance to the needy? YES NO
119. Do you find it hard to help others have a good time at social gatherings? YES NO
120. Do you enjoy helping people who are less fortunate than you? YES NO

GO RIGHT ON TO
THE NEXT COLUMN

Section 2 A
(number right)

GO RIGHT ON TO
THE NEXT PAGE

Section 2 B
(number right)

SECTION 2 C

121. Does the younger generation get so fresh with you that you have to get even with them? YES NO
122. Do your friends attach so much importance to money and clothes that you have to take some things to keep up appearances? YES NO
123. Are you often forced to show some temper in order to get what is coming to you? YES NO
124. Are many of your acquaintances so conceited that you find it necessary to insult them? YES NO
125. Do you often have to insist that your friends do things that they don't care to do? YES NO
126. Do you find it easy to get out of trouble by telling "white lies"? YES NO
127. Do you have to assert yourself more than others in order to get recognition? YES NO
128. Do you believe that society would be better off if people were permitted to behave more nearly as they please? YES NO
129. Have you found that using a little force helps convince stubborn people? YES NO
130. Are your friends and associates often so unfair that you do not respect them? YES NO
131. Do people who leave their houses or cars unlocked deserve to have things stolen? YES NO
132. Does someone at home disturb you so much that you find it necessary to "squelch" them? YES NO
133. Have you found that getting even is better than "taking it" too much of the time? YES NO
134. Do you sometimes think that it serves people right when their property is damaged? YES NO
135. Have many people treated you so unjustly that you are warranted in having a grudge against them? YES NO

GO

RIGHT ON TO
THE NEXT COLUMN

Section 2 C

(number right)

SECTION 2 D

136. Is your family interested in becoming acquainted with your problems? YES NO
137. Do the members of your family get along with each other as well as you would like? YES NO
138. Does your family seem to believe that you are not thoughtful of them? YES NO
139. Are some members of your family too extravagant? YES NO
140. Are things difficult for you because your family is usually short of money? YES NO
141. Are you troubled because members of your family differ from you regarding beliefs and standards? YES NO
142. Are you troubled because some members of your family do not get along well together? YES NO
143. Do you have better times somewhere else than where you live? YES NO
144. Do you like the members of your family about equally? YES NO
145. Does your family appear to think that you are as successful as you might be? YES NO
146. Do members of your family have as good times together as you wish? YES NO
147. Do some of the members of your family usually fail to return favors? YES NO
148. Do friends respect your rights better than members of your family do? YES NO
149. Do members of your family like to have you enjoy yourself? YES NO
150. Do you avoid inviting people to your home because it is not as attractive as it should be? YES NO

GO

RIGHT ON TO
THE NEXT PAGE

Section 2 D

(number right)

SECTION 2 E

(Consider work to mean miscellaneous duties and household work as well as regular employment. If not employed at present, give your opinion on each question.)

151. Do you worry a lot about your daily work? YES NO
152. Do you feel that most employers keep in mind the welfare of their workers? YES NO
153. Would you be much happier if you had more freedom in your work? YES NO
154. Would you much rather do some other kind of work than the kind you are now doing? YES NO
155. Are you doing the kind of work you like best? YES NO
156. Have you found that those in authority tend to avoid you? YES NO
157. Do you feel that many employers are unfair in their methods of making promotions? YES NO
158. Is it your belief that it is often difficult to gain promotions on the basis of merit? YES NO
159. Do you feel that the chances of improving the conditions of your work are good? YES NO
160. Do you feel that others could make your work easier for you if they cared to do so? YES NO
161. Would you rather work alone than with others? YES NO
162. Do you feel that those engaged in work similar to yours really like you? YES NO
163. Do those with whom you work sometimes seem unreasonable in their dealings with you? YES NO
164. Do you sometimes wonder whether people approve of your work? YES NO
165. Do you have too small a share in deciding matters which affect your work? YES NO

GORIGHT ON TO
THE NEXT COLUMNSection 2 E
(number right)

SECTION 2 F

166. Are you usually in favor of reducing all public expenses? YES NO
167. Do the churches in your neighborhood seem to meet the needs of the people? YES NO
168. Are there many people in your community who are unpopular? YES NO
169. Do you feel that many fine families live in your neighborhood? YES NO
170. Do you often discuss community problems with people in your neighborhood? YES NO
171. Do you think your neighborhood would be better if more people minded their own business? YES NO
172. Would you welcome most of your neighbors into your home as friends and associates? YES NO
173. Does your community do as much for its people as you think it should? YES NO
174. Do most of the people in your community disagree with you in political matters? YES NO
175. Is there too much neighborhood gossip in your community? YES NO
176. Are political issues so involved that you frequently do not vote? YES NO
177. Do you feel that most women's and men's clubs are of doubtful value to their communities? YES NO
178. Do you feel that most of your local public officials are honest and efficient? YES NO
179. Do you feel it is worth-while to spend time in improving your community? YES NO
180. Do you feel that many local business men do not merit your patronage? YES NO

STOPNOW WAIT FOR
FURTHER INSTRUCTIONSSection 2 F
(number right)

EGGERTS SYLLOGISTIC REASONING

ANSWER SHEET

Name _____

Age _____

Education
(Highest grade
finished) _____

1. T F
2. T F
3. T F
4. T F
5. T F
6. T F
7. T F
8. T F
9. T F
10. T F
11. T F
12. T F
13. T F
14. T F
15. T F

16. T F
17. T F
18. T F
19. T F
20. T F
21. T F
22. T F
23. T F
24. T F
25. T F
26. T F
27. T F
28. T F
29. T F
30. T F

Therefore, every A is B.

DIRECTIONS:

You will be given a number of short paragraphs similar to the examples shown below. Each paragraph consists of two statements and a conclusion. The truth of the conclusion depends upon the first two statements. Your problem is to decide whether the conclusion is true or false.

EXAMPLE: Every C is B.

Every A is C.

Therefore, every A is B.

In the above example, the conclusion that every A is B is true, for it follows from the first two statements.

ANOTHER EXAMPLE: Every C is B.

Every A is C.

Therefore, some A is not B.

In this example, the conclusion is false, for it does not follow from the preceding statements.

Mark your answers on the Answer Sheet. If you think the conclusion is true, make a circle around the letter T. If you think the conclusion is false, make a circle around the letter F.

Answer each one carefully. Be sure not to skip any. Work as rapidly as you can without making mistakes.

DO NOT TURN THIS PAGE UNTIL THE SIGNAL IS GIVEN.

1. Every C is B.
Every A is C.
Therefore, no A is B.
2. No B is C.
Some A is C.
Therefore, some A is not B.
3. No C is B.
Some C is A.
Therefore, every A is B.
4. Every B is C.
Some A is not C.
Therefore, some A is not B.
5. No B is C.
Some A is C.
Therefore, every A is B.
6. No C is B.
Some A is C.
Therefore, no A is B.
7. No B is C.
Every A is C.
Therefore, no A is B.
8. Every C is B.
Every A is C.
Therefore, some A is B.
9. No C is B.
Every C is A.
Therefore, every A is B.
10. No C is B.
Some A is C.
Therefore, every A is B.

11. Every B is C.
Some A is not C.
Therefore, every A is B.
12. No C is B.
Some C is A.
Therefore, some A is not B.
13. Some C is not B.
Every C is A.
Therefore, some A is not B.
14. Every C is B.
Some A is C.
Therefore, no A is B.
15. Every C is B.
Some C is A.
Therefore, some A is B.
16. Every C is B.
Some C is A.
Therefore, no A is B.
17. Some C is B.
Every C is A.
Therefore, some A is B.
18. Every B is C.
No A is C.
Therefore, some A is B.
19. No C is B.
Every A is C.
Therefore, some A is not B.
20. No C is B.
Every C is A.
Therefore, some A is not B.

21. Every C is B.
Some A is C.
Therefore, some A is B.
22. No C is B.
Every A is C.
Therefore, some A is B.
23. Every B is C.
No A is C.
Therefore, no A is B.
24. Every C is B.
Every C is A.
Therefore, some A is B.
25. Some C is B.
Every C is A.
Therefore, no A is B.
26. Some C is not B.
Every C is A.
Therefore, every A is B.
27. Every C is B.
Every C is A.
Therefore, no A is B.
28. No B is C.
Every A is C.
Therefore, some A is B.
29. No C is B.
Every A is C.
Therefore, every A is B.
30. No C is B.
Every A is C.
Therefore, no A is B.

APPROVAL SHEET

The dissertation submitted by Mary McNeill has been read and approved by five members of the Department of Psychology.

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

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

Jan 14 '59
Date

J. W. Herrick
Signature of Adviser