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The Influence of Induced Attitudes in Problem Solving

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THE INFLUENCE OF INDUCED ATTITUDES IN PROBLEM SOLVING.

BY

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CHAPTER I

THE PROBLEM

The work here presented is an attempt to study experimentally the influence of previously induced attitudes on performance in problem solving. If it can be shown that a certain attitude can improve a subject's performance, that fact can be used by the school teacher, the psychometrist, and the industrialist. In other words, this problem may have some very practical applications.

The attitudes here studied are emotional in nature. A definition of terms will prevent misunderstanding. What is meant by emotion? There is the inadequate definition of the behaviorists, which states that emotions consist of bodily changes only. The James-Lange theory defines emotion as knowledge of bodily changes, or in paraphrase, we are afraid because we run.

Another definition of emotion is taken from the text-book by Boring, Langfeld and Weld. It states: "An emotion is the total of the experience of an individual during any period of time when marked bodily changes of feeling, surprise or upset occur. ... For an emotion to be an emotion it must be part of an entire integrated situation" (5 :398). The phrase "total of the experience of an individual" may imply much or little depending upon the interpretation it receives, and it needs to be interpreted. If the term "experience" is used accurately, consciousness is involved, and intellect is thereby

implicitedly included. Intellect does not usually function without will, for when man acts all of his faculties and powers ordinarily act. So, to make implicate all of the implied elements in this definition it might be worded something like this: Emotion is an upset condition consisting of knowledge of the causative object which in turn repels or attracts the will, and is accompanied by visceral changes. Thus, there is activity on the psychological and on the physiological levels during an emotion.

This has been stated more concisely by Vincent V. Herr, S. J. in these words: "These" (emotions) "are conscious states of excitement, at the recognition of a stimulating situation, accompanied by disturbed conditions of the whole bodily mechanism" (20 :30). Again, the same author writes, "an emotion is a conscious movement of the spontaneous tendencies of a person, aroused by some stimulation, and characterized by peculiar modifications of the ordinary bodily activities" (20 :16).

A sampling of the definitions of emotion by Scholastic authors shows a striking similarity to one another and to the one just quoted. For example, Brennan writes: "For Aquinas, emotions are movements of the sensory appetites, following upon conscious recognition of some stimulus, and characterized by definite modifications in the regulated activities of the body" (6 :264). Maher writes that emotion "literally means a movement or perturbation of the soul...commonly employed to denote certain complex forms of cognitive and appetitive

consciousness in which the latter element is predominant"

(30 :425). Lindworsky brings out a new element in the relationship between emotions and feelings when he defines emotions as follows:

Strong feelings which are connected with a disturbance of the normal course of images, and are accompanied by noticeable bodily changes, we call emotions--older writers, passions. These emotions differ from the average experienced higher feelings only in degree. The emotion begins with a feeling impulse; then it becomes for the most part silent; the images become, for the moment, inhibited, in order then in the case of pleasure to pass quickly, and in the case of unpleasure, to continue to be inhibited. ... Individual emotions have, moreover, quite characteristic accompanying phenomena, such as the thumping of the heart in fear, and the relaxing of the muscles in strong fright (26 :296).

There is even more variety in the definitions of attitude than is found among the writers on emotion. In fact there are almost as many definitions of this concept as there are writers. The discussion of this term seems to have started at the beginning of this century when the Würzburgers were pioneering in the study of the thought processes. In W. F. Book's study "On the Genesis and Development of Conscious Attitudes (Bewusstseinslagen)"(4), there is a brief description of the findings of the members of the Würzburg School, as follows: In 1901 Mayer and Orth in working with word association lists, found that words were sometimes recalled by means of interpolated processes which might take the form of volitions, words or "peculiar conscious processes not characterizable in detail." Also in 1901, Marbe, in reporting his work on judgment, described the same phenomena and gave a long descriptive list of these

attitudes, but also stated that they could not be adequately described. According to Titchener (44 :101), Marbe's observers said that these attitudes were peculiar, indefinite, or indescribable, but they were able to characterize them in a more positive way and gave us hints of the behavior of attitudes in the general flow of consciousness. In 1903 Orth concluded that "one characteristic common to various imageless conscious processes was the quality of obscurity and intangibility" (4 :381). Messer distinguishes a group of intellectual and a group of emotional attitudes; the former are matters of understanding while the latter are complicated by affective and volitional moments. He writes that anything and everything that can be made the topic of thought may appear in the form of a conscious attitude. Messer's intellectual attitudes correspond to Ach's awareness of meaning, and his emotional attitudes to Ach's awareness of relation. Messer supplements Ach by pointing to the transitional forms of development or elaboration that a thought process may pass through in consciousness (44: 108 - 111).

In 1910, Book (4) published an account of some experimental work which had been performed five years previously. Following his study and analysis of the learning consciousness of his subjects while they were learning to typewrite, he points out that all previous findings were not contradictory, but appeared to be so, because the various studies had observed the same group of phenomena at different stages of its development (4:396). He concludes that attitudes represent the "devel-

oped forms of representative processes made imageless by practice and use. ... Attitudes are midway between vivid imaginal processes regularly operative in consciousness and such internal stimuli as auto-suggestion. Conscious attitudes seem to represent a stage in the process of development which begins with vivid imaginal thought and slowly passes downward to a stage of automatic or instinctive control" (4:395 - 397).

The use of the term attitude continued to grow. In 1924 Symonds (42) found seven meanings of the term in the writings of educators and psychologists. These are as follows:

1. Attitude refers to great organic drives more familiarly known as purposes or motives.
2. Attitude refers to muscular set or adjustment.
3. Attitude refers to generalized conduct.
4. Attitude refers to neural set or readiness to make certain reactions.
5. Attitude refers to the emotional concomitant of action.
6. Attitude refers to the feeling concomitant of action.
7. Attitude refers to certain verbal responses indicating liking or disliking, acceptance or rejection.

Symonds concludes that the term is used, not to refer to a "specific kind of reaction, but that the word either duplicates what we know as skill or habit, or is a term used to refer to particular features such as the affective side of reaction units."

Sullivan (41) defines attitude as an "intellectual affair which may or may not be complicated by emotional elements. ... Attitudes are ideas or meanings which have been set off in the organism by external and preceding or accompanying determination. These ideas do not characterize the particular situation, but do characterize the immediate nature of the responding organism. Therefore they may vary the nature of the

response."

Farris (15) characterizes attitudes as tendencies to act.

In writing of Ruger's work on the solution of mechanical puzzles, Murphy (34) states that the concept of attitude "while borrowed from the Würzburg experimentalists, was not, as with them, that of a new kind of structure, but that of a way of facing a situation."

Droba (14) classifies definitions of attitudes under the following headings:

1. Organic set type: An attitude is largely a physical preparation to action, either motor set, or neural set. An example of this type is Allport's definition: "Attitude is a motor-set built up by suggestion."
2. General theories: An attitude "denotes the general set of the organism as a whole toward an object or situation which calls for adjustment" writes Lundberg. Droba criticizes this definition as being too vague.
3. Behavior theory: Attitude is behavior, not preparation for action.
4. Mental preparatory set: Stresses readiness to act rather than behavior itself. One example of this type of definition is Bogardus': "An attitude is a tendency to act toward something in the environment, which becomes thereby of positive or negative value."
5. Other types: North's definition states that an attitude is a motive for activity. The attitude points the direction activity will take, motives are the starters.

Droba's definition is that an attitude is the mental disposition of the individual to act for or against a definite object. We are conscious of the object and its value toward or against which we take a certain stand.

Another collection of definitions, this one compiled by Nelson (35), includes some sociologists' viewpoints. Among these is Pritchard's definition which states that an attitude

is an "enduring stereotyped and socially compelled behavior pattern, together with its concomitant psychological processes both in conscious (sentiments) and in the unconscious (complexes)." Dewey describes attitude as "something latent, potential, something which requires a positive stimulus outside of the individual in order to become active." The compiler's definition states that "an attitude may be considered a felt disposition arising from an integration of experience and innate tendencies, which disposition modifies in a general way the responses to psychological objects."

Vincent V. Herr, S. J., in "Introduction to Social Psychology (20 :53-55) writes: "An attitude of will means literally a firm resolve or determination to act in a given way under a given set of circumstances. ... It is equivalent to an habitual intention of the will." He points out that there are mental and volitional attitudes which may be emotional or intellectual.

What is an attitude? Is it imageless thought? Neural set? Behavior? Is it an intellectual affair with or without emotions, or a way of facing a situation? To help solve this difficulty authors now are drawing fine distinctions between attitudes and habits, attitudes and sentiments. Thus Tuttle (45) writes that "sensory-motor-arc habits are fixed responses along the line of least neural resistance. ... When some element of worth, of interest, of desire, related to the service rendered by any particular response, determines the form of that response, it is essentially an attitude."

Bertocci (3) writes that Allport's use of attitude as both a driving and a directive influence is confusing, and hence that the word "sentiment" should be used to express driving experience reserving the term "attitude" for less intense directive experience. Catell (7) suggests a new word to guide us to clearer thinking on the subject of attitudes. His suggestion is "metanerg" which is to mean a "disposition to react emotionally, cognitively or conatively towards a situation in a stable manner with or without awareness of the goal of reaction," which is distinguished from sentiment in that the latter is a "relatively permanent major disposition" and is aware of goal and of manner of reacting. In contrast to this an "attitude is a disposition to react with belief, thought, feeling and overt behavior in a certain way towards a certain object as part of the purposive plan of a larger sentiment, with full awareness of the object and mode of reacting."

However, the word attitude is not unknown by that famous "man of the street", even though he has not read the theoretical discussions and definitions of the term. If he were quizzed on the subject he might find it hard to explain what he understands from that term, but he can cite numerous examples of it. He may say that attitude is the stand he takes on a subject. Father McCarthy (28) expressed it well, in simple language for the "man of the street" when he wrote that it is "an acquired tendency to think and to feel in certain definite ways. ... It is ordinarily toned with emotion."

Attitude may mean any one of many different and often vague phenomena. Thus we see different authors applying this term to such widely differing things as neuro-muscular sets, faded or clear imaginal constellations, intellectual concepts of value, temporary or more permanent dispositions of will toward a value or set of values, and to states similar to the last named, but more or less shot through with feeling or emotion. In the present study the word is taken to signify emotionally toned dispositions of will which it was the experimenter's endeavor to establish indirectly by the tone of preliminary instructions. Thus it will be seen that the meaning attached to the term here resembles the description of attitudes found by Ruger, and is partly similar to the fifth category of Symond's classification. It was thought best to endeavor, through instructions, to establish the attitude thus described, and then assuming the presence of this attitude, to measure its effect by a record of the subject's performance in problem solving. Whether or not these assumptions are valid will be brought out in the discussion of the experiment.

CHAPTER II

REVIEW OF RELATED LITERATURE

In glancing through current psychological literature, one is impressed by the quantity of studies on attitudes. During the past decade most of this work has been on the construction of attitude scales with which to measure humanity's attitude on any question from pacifism to employers. Thurstone (43) in 1928 wrote an account of how such a scale could be constructed, and then proceeded to construct many different scales. Chave (11) in the same year, was also describing his method of scale construction. Once such scales were available and attitudes were being measured educators, psychologists, and sociologists seemed to be eager to discover how attitudes could be changed and how permanent these changes are. Some effective modifiers of attitude have been found to be movies, lectures, reading and personal experiences. Some of the contributors to this phase of the study of attitudes are Fernberger (16), Cherrington (9), Chen (8), Kulp (25), Rosenthal (38), Kirkpatrick (23), Knower (24), and Older (36).

Previous to this phase of measurement, several studies were aimed at analysis and description of varied attitudes. Experiments in problem solving and in learning were used to evoke the attitudes studied. One of the earliest published accounts of this type was that of Ruger in connection with the solution of mechanical puzzles (39). He describes three attitudes which are: (1) Submissive or suggestible attitude adopted by some Os in the presence of a person who

knows the answer. The object of attention is the person with the "prestige suggestion", rather than the problem itself.

(2) Self-attentive attitude in which O's attention is on self and not on the problem, as though the self were on trial. Worry and emotional tension further distract attention from the problem. These two attitudes both arise from the lack of self-confidence, and are apt to appear in novel situations where O thinks he is ignorant. (3) Problem attitude, characterized by self-confidence, "not of sluggish complacency but expressed in a high level of intellectual activity of attention to a thing to be done." Suggestions are critically evaluated and the mind is open to novel lines of attack.

H. M. Clark (10) had seven Os perform several tasks for the purpose of studying the accompanying attitudes. The situations were designed so that various attitudes would be likely to occur. The first task was learning to read raised letters through the fingers. The second series was recognition of blanked-out faces on old familiar pictures. The third series was the seeking of relationships. Four hundred attitudes were named, three fourths of which were more or less completely analyzed. The general conclusion was that "conscious attitudes can be analyzed into sensations and images and feelings, or traced genetically to such analyzable complexes, and therefore do not warrant the proposal of an additional conscious element."

Stella B. McCharles (29) planned and executed an

experiment to determine the effect of certain attitudes on the ability of five groups of subjects to solve problems. One group was given instructions which were designed to produce an attitude of pugnacity, another friendliness, a third alertness, a fourth relaxation, and the last group no attitude except the Aufgabe. While maintaining these attitudes O was asked to solve problems on the Yerkes Multiple Choice Box. The problems were provided by arranging black disks on a row of twelve white spots. The work was carried on in five twenty-minute periods, distributed over two weeks. At the conclusion of the work O was questioned to determine if attitude had been taken and maintained. Significant differences were found, and the conclusion was advanced that the attitude of pugnacity definitely promoted a higher efficiency in solving these problems.

In studying emotional attitudes, Ellen S. Sullivan (41) used memory series. O was told that his performance on a previous occasion had been either best or worst of the group, regardless of actual performance. It was found that subjects for whom the task was difficult were more affected by this information than subjects for whom it was easy, and women were more affected than men. Knowledge of failure increased the time required to learn the memory series and knowledge of success decreased it.

Shaw and Crumpton (40) published a report on a series of studies of children's handwriting skill. The training in

the skill of writing is handled through a handwriting club in the English department. It was found that this club was instrumental in developing useful attitudes. The conclusion is that attitude is a potent factor in the development of skill.

O. D. Anderson in "An Experimental Study of Observational Attitudes" (2:345 - 346) writes:

An observational attitude, in this contest, means a way-of-taking a task and a mode of adjusting oneself to an experimental setting. It may involve anticipation or intent, and it will presumably rest, in part, upon O's comprehension of the formal instructions and, in part, upon any kind of non-formal instructions or hint which arises from the O himself and from the occasion. Ultimately, of course, the observational attitude will have one strong root in the past history of the organism.

Three Os were presented with simple visual stimuli in Series I and with auditory stimuli in Series II, with the instructions that they were to observe and report on their "initial way-of-taking the stimuli" and on changes in attitude. In Series III a combination of two colors were used as stimuli; Series IV used bi-tonal combinations; Series V used a combination of two colors with a distortion of spatial configuration of the circular field; Series VI used two single tones rhythmically presented in rapid succession. In these last four series the Os were told to report on their enjoyment, appreciation, approval or disapproval of the stimulus. In Part II more complex visual and auditory stimuli were used, with instructions that O was to adopt a

particular attitude which had appeared in the previous part of the experiment, and to give a complete account of the course of experience which occurred under that attitude.

Six different attitudes were found and enumerated, which ranged from a casual survey of the objects to an esthetic appraisal of them. One of the conclusions drawn from this study is as follows:

When observers are specifically instructed to adopt a certain type of attitude they usually succeed in the pre-exposure period; but they fail, on the whole, to maintain this particular attitude during an entire period of stimulation no longer than five or ten seconds. This failure results in a variety of performances among which the performance corresponding to the attitude specified by formal instruction appears about one half the time. We conclude from this fact that the specific instructions designed as a means of assuring constancy of attitude and performance in experimentation, is by no means adequate even where observers are highly trained and carefully instructed. As an approach to an adequate control of attitudinal conditions, it appears that frequent determinations of attitude must be made throughout any series of observations in description and in psychological experiments, and that self and occasional instructions have quite as much to be taken into account as determinants of our psychological performance as have verbal commands of the formal kind (2 :368 - 369).

An unpublished dissertation by Charles I Doyle, S. J., written on "An Experimental Investigation of the Process of Inductive Discovery With Groups of Closely Similar Problems of Variable Complexity" has as a minor aim "a preliminary investigation of the influence of scientific attitude and method in solving complex problems. (13: 4) The apparatus used was a multiple-choice keyboard con-

sisting of four numbered keys connected with a bell which could be rung only when the correct sequence of two keys was struck. This sequence of keys could be changed for each problem. One group of Os received detailed instructions on the scientific approach to the problems. The effect of these instructions, according to the author, seems to be two-fold: "a lowering and a leveling of scores," especially in the first problem of the series, but was less marked on the other ten problems. This may be due to the fact that the instructions were helpful only in the inductive work, which was principally in the first problem. The author continues:

It is problematical how much of the gain derived from the instructions should be attributed to attitude, and how much to method. Practically the two cannot be separated. It would be difficult to devise a set of instructions in method which would not have to establish an objective attitude before they could be made operative for method. To judge from the protocols of one of the Ss who failed in this group, and of one of those who completed the work with great difficulty, attitudes of diffidence or inferiority were not always overcome by the Preliminary Instructions. (13:41)

Freeman (17) in studying the influence of attitude on learning used four Os who were to form an association between four common musical chords and four reaction keys under varying conditions. He found that mere repetition is not economical in learning complex material and that an attitude of insight is desirable.

G. Luntkowski (27) studies two attitudes, the active and the passive attitude in an experiment. The active

attitude is induced by more difficult tasks and tends to give better results. Some Os naturally assume one attitude, some the other. The task was to divide a given linear distance into three equal parts by shifting beads on a string. In the first part of the experiment no directions as to attitude or method were given. At its completion the Os were questioned as to attitude and it was found that sixty out of the eighty-two experiments had been carried out with an active attitude, and eleven had been passive. Errors were smaller in the active group, the difference being more conspicuous the larger the space to be divided.

In the second part of Luntkowski's experiment four predominantly active and three predominantly passive Os were used. An equal number of instructions favoring active and passive attitudes were given in variable order, and the Os were again questioned at the completion of the task. Active instructions were followed successfully in almost all cases; passive instructions were completely followed every time by one O, seventy percent of the time by five Os, and never by one O. It was found that Os tended strongly to one attitude, but the other one, especially the active one, could be assumed. The assumption of the passive attitude is easier when the space is small.

Another type of attitude, writes J. J. B. Morgan, (33) is suggestibility, or set which makes a person amenable to a wide range of stimulus-situations. He states that suggestibility is related to the neural phenomena of

facilitation, which in turn relates it to the neural set type of attitude found in some of the classifications in the previous chapter. Morgan states that a person is suggestible when "tuned" to respond to some external situation.

Related to this field of investigation is C. W. Manzer's (32) study of the effect of verbal suggestion on output and variability of muscular work. One hundred subjects, fifty men and fifty women were used, and the apparatus was a Smedley hand dynamometer. Subjects were told their task was easy, hard or medium, when in reality it was always the same. The suggestion "hard" increased the amount of work done by both men and women; the suggestions "easy" and "medium" decreased output with men, but not with women. Variability of output was increased by all three suggestions with both men and women.

A study related to the minor investigation of this thesis was done by J. H. L. Roach in his "Experimental Study of Suggestibility in Extroverts and Introverts" (37). He found that extroverted women tend to be more suggestible than introverted, but no similar relationship appears with men. He also found that suggestibility is inversely related to scholarship and scholastic aptitude test scores.

The studies which have been reported up to this point have some bearing on the matter of this thesis. There are many other studies on attitude which reveal the great amount

of interest aroused by the different concepts expressed by this one term "attitude". Among these are "The Influence of Attitude on the Conditioned Eyelid Response" (19), "Attitudes and the Galvanic Skin Reflex" (1), "Physiology of Attitude - Emergence of Ego-Organization" (22) which is concluded with a statement of the law of attitudes and its eight corollaries. Since these and the many other investigations of attitudes which have been reported in the psychological literature, seem to have no direct bearing on this experiment, they will not be further discussed here. Neither will the extensive literature on problem solving be reviewed here for it does not pertain directly to the subject of this thesis.

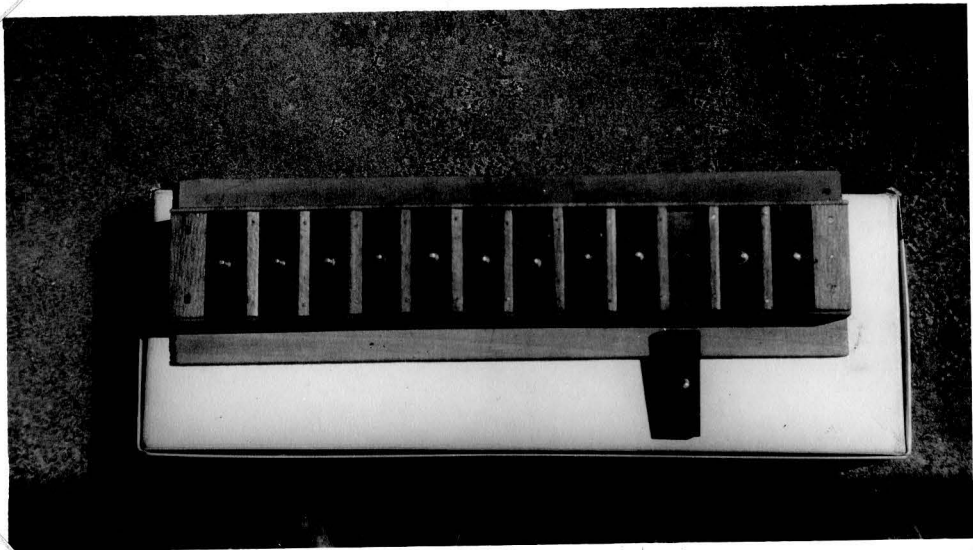
Of the experiments here presented, two are a direct study of the influence of attitudes experimentally induced, as is this experiment. Stella B. McCharles found that an attitude of pugnacity definitely promoted higher efficiency in problem solving. Ellen B. Sullivan found that the emotional attitudes generated through knowledge of success or failure had very definite effect on the length of time required to learn a memory series. Less closely related is the work of Clark, Shaw and Crumpton, Anderson, Freeman, Luntkowski, Manzer and Roach. Intermediate between these two groups is the work of Doyle and Ruger. The present work is an attempt

to make clear the influence of experimentally induced attitudes, understood as defined in scholastic terms at the end of the last chapter. It shows the influence of attitudes upon performance in problems involving inductive discovery.

CHAPTER III

THE EXPERIMENT

APPARATUS. The Yerkes apparatus is designed to study inductive discovery by performance in selecting the "significant" key from a key board on which any number from two to



The Problem Box

twelve keys may be presented. By the "significant" key is meant the one with which, according to the plan or pattern chosen by the experimenter, a buzzer has been secretly and temporarily connected. The plan or pattern selected by the experimenter is kept constant throughout the series of

presentations leading to a successful inductive discovery. Any number of problems varying in difficulty can be designed by the experimenter. For example, the right hand key of a group, the second from the left, the key next to a vacant space, the key to the right of the middle, etc., etc. Yerkes lists twelve problems (46). The subject's attack on the first presentation of the problem is necessarily a random one. Induction is possible only on the basis of a series of presentations where the "significant" relationship is kept constant, but the total number and positions of keys presented is varied from trial to trial.

The twelve keys of the Yerkes Multiple Choice Apparatus are paralleled, in this problem box, by twelve compartments each with an individual lid. A small object (in this experiment it was a screw), is hidden in the "significant" compartment. The compartments that are not being used in a particular presentation are left uncovered. All the relationships that are possible with the Yerkes apparatus are also possible with this simple piece of apparatus.

SUBJECTS. Forty-two subjects worked in this experiment. Four were used in the preliminary work, and thirty-eight in the actual experiment, but the work of two in this group could not be used. All of these subjects were adults. The group used in the preliminary stage consisted of three men and one woman, of whom one was a professor in psychology, and the other three had no psychological training. The group working on the experiment proper was composed of ten men and twenty-

six women. Eleven of this group were graduate students in psychology, eleven were school teachers, and fourteen had no psychological training, their occupation ranged from engineering through clerical work to factory work, and their education ranged from somewhere in the grammar grades to a college degree. (See Table I.)

Table I
Classification of Subjects

	Teachers		Psychology Students		Untrained		Total
	Male	Female	Male	Female	Male	Female	
Preliminary Work			1		2	1	4
Actual Experiment	11		6	5	4	10	36

Since the work of the entire group under one type of instructions is being compared with their work under the other type of instructions, it was not necessary to equate these three sub-groups in mental ability or educational background. Rather, a heterogeneous group was thought to be desirable, so subjects were picked at random.

PROBLEMS. The preliminary work of this experiment was to determine the relative difficulty of each problem before the two groups of problems were arranged. In the experiment proper, each subject solved eight problems, two introductory practice problems, and the two main groups of three problems each, the two groups being of approximately equal difficulty.

Of the introductory problems, one had a relationship to the entire box, regardless of the number or position of lids used, and the second problem had a relationship to one end of the series of lids used. In the group of three problems, the first one bore a relationship to one end of the series of lids used, the second one to the entire box, and the third one to the center of the series of lids.

Six of the problems used were taken from Yerkes' list of problems which he suggested for further study (46:39 2). The other two problems were arranged by the experimenter. This apparatus lends itself to very difficult relationships, as pointed out earlier in this chapter, but the problems were purposely kept simple so they could be used with a heterogeneous group. After ten presentations of a problem, when it was necessary to continue it, these same first ten arrangements were repeated. If O noticed this similarity, as many did either from the sequence of correct responses observed from their notes, or from the number of uncovered compartments at each end, the position of the lids, but not their number, was varied. This could be done only in those problems having a relationship to the series of lids used. (For the list of problems see Appendix I.)

PROCEDURE. The subject was seated across the table from E. Paper and pencil were provided for the subject with a casual remark that he could take as many notes as he wished. With the first presentation of the first introductory problem these instructions were given: "Under one of these covers

a screw is hidden. Find it." With the second presentation further instructions were given as follows: "See if you can discover the plan whereby you can find the hidden object each time." For subjects who were having difficulty in solving the first introductory problem and who were not taking notes, the remark was made that perhaps taking notes would help them. Some had to be assured that there were no trick presentations, that each one followed the same plan in the same problem. A few had to be reassured that there were no clues on the exterior of the box. Most of the subjects feared that the experiment was a mental test. They were told that it was not and were promised that an explanation of the entire experiment would be given at the end of the work. Up to the completion of the second introductory problem the procedure in all major matters had been the same for all subjects.

The two attitudes here being studied are (1) the objective, scientific manner of approaching and meeting this problem situation, and (2) the subjective, diffident manner of approaching and meeting this same situation. The instructions were designed to produce these attitudes while O's attention was supposed to be focused on the problems. Thus, the instructions framed to produce the objective attitude are as follows: "The next group of problems can be solved by an objective, scientific attitude on your part. Tackle them calmly and deliberately." Those used to produce the

subjective attitude are as follows: "The next group of problems are very difficult. They require an alert, keen mind to solve them. They may take quite a long time if they are successfully solved. Do your best."

Variations in procedure were used with four sub-groups in order to cancel out variable results due to practice effects, possible inequality of problems, and the survival of previously induced attitudes, thus better isolating, as far as possible, the influence of the experimenter's instructions in establishing a definite attitude in the subject. Group I had the "A" group of problems with the objective instructions first, then the "B" group of problems with the subjective instructions; Group II had the "B" problems with the subjective instructions first, then the "A" problems with the objective instructions; Group III had the "A" problems with the subjective instructions, then the "B" problems with the objective instructions; Group IV had the "B" problems with the objective instructions, then the "A" problems with the subjective instructions. The first subject taken was in Group I, the second in Group II, and so on down the line. (See Table II).

Records were kept of the number of presentations in each problem, and of the number of lids lifted in each presentation. If the problem was not solved on thirty presentations, the explanation was given either directly or through leading questions. There was one exception to this

routine. One subject seemed to be blocked on one problem, so the series of presentations was continued and he succeeded on the thirty-fourth. When O could always find the hidden object through notes taken on previous presentations, but could not make a general statement of his solution of the problem, he was penalized two presentations and the problem was discontinued, as he had stopped trying, seeming to be satisfied with his performance. This happened in five cases.

Table II

Distribution of subjects into sub-groups.

	GROUP I	GROUP II	GROUP III	GROUP IV	TOTAL
SUBJECTS	1. T-f	2. P-m	3. U-f	4. T-f	
	5. P-m	6. T-f	7. T-f	8. P-f	
	9. U-m	10. P-m	11. P-m	12. T-f	
	13. T-f	14. T-f	15. T-f	16. T-f	
	17. U-f	18. U-f	19. U-f	20. T-f	
	21. U-f	22. U-f	23. U-f	24. P-f	
	25. P-f	26. P-f	27. U-f	28. U-m	
	29. P-f	30. P-m	31. P-m	32. U-m	
	33. U-m	34. T-f	35. U-f	36. U-f	
	9	9	9	9	36

T-Teacher

P-Psychology student

U-Untrained

m-male

f-female

It was thought that the number of lids lifted and the number of repetitions in lifting lids were not as significant as the number of presentations. Hence only this last record

was used in the statistical treatment of the scores. Repetitions were avoided by some subjects who left the lids off. Some subjects did most of their thinking with paper and pencil, so with them there was less random lifting of lids, and their score of lids lifted was consequently low.

The situation was kept informal. All of O's comments and theories were recorded, but questions obviously could not be answered. No information, except that contained in the instructions, was given after the completion of the two introductory problems. In those cases where O seemed to be discouraged, the attitudinal instructions were repeated in this manner: "You remember, I told you these problems were very difficult:" or "I told you that these problems could be solved. Tackle them calmly." When O became impatient and wanted to quit, he was asked to continue with the problem a little longer. Most of the Os were willing to do so. When O lifted the correct lid first in a presentation, if no theory was offered, E asked for one. When the correct answer was given, it was neither affirmed or denied by E, but two more presentations were given to prove or disprove the hypothesis. When a new problem was started, it was so announced.

The records of two subjects who necessitated variation in the procedure could not be incorporated in this study. One of these Os became very upset, stated that she had tried all possible relationships, so the problem must be **wrong**. At this point, on the nineteenth presentation of the problem,

she was helped to find the answer through leading questions. The other subject gave no evidence of learning. After four and a half hours, on the twenty-fourth presentation of the seventh problem, her performance showed that her work was still random, and the explanation was given. Again on the eighth problem she showed no evidence of approaching a solution and the experiment was terminated forthwith. Her performance was interesting, in that when she had found the correct solution, she would not try it on the next presentation of the same problem, but picked up lids at random. She developed no method of attacking a new problem, and seemed to be as confused at the end of the series as she was at the beginning. She worked slowly, taking long periods between presentations, made a few notes, made few comments, offered few theories, and learned nothing from previous problems. Her note taking consisted of such comments as these: "Find solution to problem. ... First lid no solution as yet. Solution - never in same box so far - as I have picked up tabs. ... Picked twice in a guess. ... Find solution. ... Changes all work. ... Relationship of ends." She also had her name scrawled a few times in very tiny letters. It seemed evident that there was a strong emotional factor blocking her performance.

The time spent in solving the eight problems varied from half an hour to four and a half hours, with an average slightly greater than two hours.

On the completion of the problems O was asked several questions casually, and the responses were recorded. The questionnaire started with an invitation for O to appraise the experiment and the problems, and all comments were smilingly accepted. Then the questions tried to determine O's attitude during the series of problems, whether or not there had been a change in attitude, and if so, when and why as far as O was aware of a change. Often the word attitude had to be illustrated, as O did not comprehend the term. These illustrations were then used: "Were you confused, or out to beat your score, or licked by the problem?" Next O was asked if he had become tired during the experiment, and finally if he was aware of an improvement in his ability to solve the problems.

The last part of the procedure was answering the questions of the Neymann-Kohlstedt Test for Introversion-Extroversion. This test had been chosen because it was well standardized, was simple to administer and to score, and was adequate for the purposes of this study. These questions were usually read aloud to O who made a verbal response, which was recorded by E. In this way, E was sure that the correct interpretation was given to each question. Then the purpose of the experiment was explained to O, according to the promise, the scores on the two sets of problems were given, and the score on the personality inventory was explained. (For a copy of this test see Appendix II.)

CHAPTER IV.

RESULTS AND DISCUSSION

The main purpose of this experiment, as stated previously, is to determine whether an attitude established in advance by instructions, has an observable influence on performance in problem solving. The two attitudes here sought are an objective approach to the problems, and a subjective approach, a feeling of inferiority. If the instructions are effective in establishing an attitude of inferiority, the performance under these instructions should not be as good as the performance under the other instructions. In other words, the number of trials needed to solve the problems should be greater under the subjective instructions if they are effective.

Thirty-six subjects completed all the problems in this experiment. As explained in the preceding chapter, the sequence of problems was varied in four ways with no attempt to equalize these four groups in mental ability, or in education. This was permissible because the scores of the entire group were to be compared, not individual scores, nor sub-group scores. The quantitative data will be considered first.

QUANTITATIVE DATA: The scores used are the total number of presentations of a problem before the successful inductive discovery. If the number of lids lifted had been used in scoring, it would make a discrimination between the performance of individual subjects, but the scores of the entire group

are here sought, not individual scores, so this more precise measure was not used. Also, the correlation between the number of presentations and the number of lids lifted was so high ($.956 \pm .0095$) that it seemed to make little difference which form of scoring was used in the statistical analysis.

The average number of presentations per subject for six problems under objective instructions is 25, S.D. 17, P.E. 1.8; under the subjective instructions the average is 34, S. D. 20.9, P.E. 2.5. The critical ratio of the difference between these two scores is 3.08, which though small is still large enough to be significant.

The factors responsible for this small value of the ratio may be many. These statistical procedures when applied to a small number of cases will always yield a large Probable Error where there is a large scatter.

Another important factor seems to be the interpretation which O gave the instructions. There was never a question raised about the meaning of the instructions designed to produce a feeling of inferiority, but the same cannot be said about the instructions intended to induce the objective attitude. Subject 24, when working under the objective instructions, said: "I am afraid I haven't a scientific mind." She seemed to be blocked on this problem, could make no generalized statement, but picked the "significant" lid eight times in succession. She was penalized two presentations and the problem was discontinued. She was not the only subject

who interpreted these instructions differently from what E had intended.

Another complete misinterpretation of the instructions was stated by Subject 26, who on the questionnaire revealed that she thought the objective instructions meant that the following problems would be harder, and she took it as a challenge to do better work. Another subject made a similar statement.

From these remarks, it is evident that more effective instructions could have been framed, instructions so worded that they would less frequently be misinterpreted. This is especially true of the instructions designed to produce an objective attitude.

Another factor was O's reaction to the instructions. When some Os were told "these problems require an alert keen mind to solve them," they took it as a challenge. Subject 15, when given the subjective instructions, added the comment: "In other words, concentrate"; and she achieved a score of 64 presentations under these instructions, as compared with 76 under the objective instructions with the second group of problems, when she had the benefit of the practice effect. Another example of this is Subject 30, who when he heard the subjective instructions, started to take more complete and adequate notes, and solved the more difficult problems in fewer presentations than he had solved the easy introductory problems. This improvement in method continued throughout the remaining problems of his entire experiment.

and when questioned after the completion of all the problems, he said that he had not paid much attention to the instructions. He certainly had paid much attention to the subjective instructions which he had first, but very little to the objective instructions.

Again, many Os were very subjective throughout the entire experiment, regardless of the instructions. One clear example of this is Subject 17, whose comments are interesting in this light. They are as follows:

Introductory I, 5. "That one looked a little out of line. You may not find out anything, but you will have a good time finding out how nutty I am.

Objective instructions. A, I, 3. (After correct solution she said:) Making it easy for me.

A, III, 4. Just guessing.

6. Don't know.

9. I can't find any relationship.

12. Just guessed

13. I must be awfully dumb. I can't see it.

18. Don't know. It gets worse.

22. The more I do, the worse it gets. It looks as though it were a multiple of two, but I know it isn't.

23. Starting multiples of three, maybe.

25. Just guessing - can't get it.

She did not solve the problem in the thirty presentations.

Her comments were much the same under the other instructions.

Subject 32, while working under objective instructions, on problem B III, made these comments:

8. I should have finished school and gotten some brains.

13. I must be a plain dummy.

These subjects and others seem to have started the experiment with a definitely subjective attitude, upon which the instructions seemed to have had no effect.

Other Os seemed to have paid attention to the instructions, but this effect was lost after they solved the first problem easily. Subject 19 showed this reaction clearly. Her record for Problem A 1, under subjective instructions, is as follows:

4. I'm no good at this sort of thing. I'm completely befuddled.
5. You did this a few times - the first lid from left. (Correct solution).
That is simple. I guess I got panicky when you said it took a keen and alert mind."

Subject 28 stated a similar reaction in the questionnaire. He said: "The first problem after you said the problems were very hard" (subjective instructions), "was the easiest one of all, so I became suspicious of the difficulty of the problems, and ignored the instructions entirely."

Returning from individual performances to group scores, we present the scores of our subjects on the two groups of problems ("A" and "B"), which were alternated. In the long run the A group of problems revealed itself as being easier than the B group of problems. The average score for the group of "A" problems is 25 presentations, S.D. 13.6, P.E. 1.5; the average score for the "B" group is 33, S.D. 25.3, P.E. 2.8. The critical ratio of the difference between these two scores is 2.75. From these figures it can be seen that the "B" group of problems seemed to be more difficult for many of the subjects, which is one of the reasons why the experiment was arranged into four sub-groups. However the difference between the "A" and "B" scores is not as great as the differ-

ence between the scores under the objective and under the subjective instructions.

Finally, it seems that whichever group of problems was presented first was more difficult than the group that followed, thus showing practice effect. Thus the average score of the problems presented first is 35, S. D. 18.5, P.E. 2.1, while the average of the group that followed is 24, S.D. 19.0, P.E. 2.1. The critical ratio of the difference between these two scores is 3.79, which is the largest of the differences. This shows the importance of the practice effect, and is the second reason for the experiment being presented as it was.

Table III

Recapitulation of group performance in terms of subjective and objective instructions, "A" and "B" problems, and first or second presentation.

	Average	S. D.	P. E.	Diff.	P. E. Diff.	Critical Diff.
Objective Instr.	25	17	1.8			
Subjective Instr.	34	20.9	2.3	9	2.92	3.08
"A" Problems	25	13.6	1.5			
"B" Problems	33	25.3	2.8	8	2.9	2.75
1st Problems	35	18.5	2.1			
2nd Problems	24	19.0	2.1	11	2.9	3.79

It is interesting to compare scores when two or more favorable or unfavorable factors were combined. These scores

are given in Table IV, P. 29. This presentation makes clear that in Group II the combination of the more difficult problems, subjective instructions, and first presentation was a heavily weighted situation, while in Group IV the combination of the facilitating factors of easier problems and second presentation obscured the effect of the instructions. It seems that only if it were possible to find a control group with the same mental ability, education and personality as the experimental group, and if this hypothetical group had worked all the problems without instructions, could we have accurately isolated the effect of the instructions.

However when we compare the total under "A" problems, first presentation, objective instructions (Group I), with "A" problems, first presentation, subjective instructions (Group III), we find that under the subjective instructions the total is 22 points larger. Similarly, comparing "B" problems, second presentation, subjective instructions (Group I), with "B" problems, second presentation, objective instructions (Group III), we find that the total under the subjective instructions is 78 points larger. Again, in comparing "B" problems, first presentation, subjective instructions (Group II), with "B" problems, first presentation, objective instructions (Group IV), it is found that the total under the subjective instructions is 116 points higher. And lastly, in comparing "A" problems, second presentation, objective instructions (Group II), with "A" problems, second

Table IV.

Individual scores arranged according to sub-groups.

		Group I	Group II	Group III	Group IV			
Subject Number	"A" Problems Objective Instructions							
1	32							
2	14							
3	23							
4	9							
5	39							
6	17							
7	34							
8	21							
9	36							
10	29							
11	34							
12	34							
13	84							
14	34							
15	34							
16	34							
17	34							
18	34							
19	34							
20	34							
21	34							
22	34							
23	34							
24	34							
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89	34							
90	34							
91	34							
92	34							
93	34							
94	34							
95	34							
96	34							
97	34							
98	34							
99	34							
100	34							
Total	372	236	396	122	294	320	280	318

presentation, subjective instructions, (Group IV), under the subjective instructions the total is 96 points larger. In this presentation where practice effect and the greater difficulty of the "B" problems are ruled out, it can be seen that the instructions were effective in every instance. (See Table IV, Page 37). (Detailed statistical treatment of sub-group scores is not presented because of the small number in each sub-group).

QUESTIONNAIRE: Some of the answers have already been given in the discussion of the total scores. The following is a more complete discussion of these findings. The answers to the questionnaire were interesting in that they often did not coincide with the performance of the subject, nor were there striking similarities in the reports of the group. In fact it seems that there were as many reactions to the interpretations of the instructions as there were reports, and almost as many attitudes reported. When asked what was thought of the experiment, the answers were "fun," "interesting," "a game," "a challenge." Seventeen Os reported no fatigue, four reported feeling tired. Fifteen subjects felt that their ability to solve the problems improved during the course of the experiment, and six did not find this improvement. Two of these who felt that they had improved had larger scores on the second group of problems than on the first, and half of those who felt they had not

improved showed better ability in solving the second group of problems. This is one of the inconsistencies in the reports.

Three Os reported that their attitude changed with their performance, that after solving a problem quickly and easily, they were confident and assured in attacking the next problem. Three Os reported that their attitude changed with the difficulty of the problem, hard problems confusing them. Of the seven Os who admitted being influenced by the instructions, three took the subjective instructions as a challenge, one looked for very complicated relationships after the subjective instructions and almost missed the easy solutions, two thought that they should try harder after objective instructions. The seventh reported that she tried to follow the objective instructions and found that she was more successful when she remained calm and deliberate.

Two Os explicitly said that their attitude had not changed, and eight reported that they had paid no attention to the instructions. Two of this group credited other factors for their change of attitude, such as their performance, or the difficulty of the problems. The balance did not state whether or not their attitude had changed. Subject 2, who had seemed to be blocked on Problem B III, under subjective instructions, was questioned rather pointedly after the experiment. He said that he had paid no attention to the instructions, had not been blocked but just could not solve the problem. However, his score under the subjective instructions was 61 as compared with a score of 9 under the

objective instructions. This report definitely seemed to be contrary to his performance. The report of another member of this group who "became suspicious of the instructions" was quoted earlier in this chapter in the comments on various reactions to the instructions.

Thus, according to the reports of the subjects, three groups manifesting different reactions to the instructions, can be formed. The attitude of the first group was influenced by several factors other than the instructions; the second group was influenced by the instructions, but the majority of them reacted differently from what was expected; and the third group reported no change of attitude and entire disregard of instructions. This is a striking instance of the well-known fact that the human being is at times unpredictable in his reactions, due to the complexity of inner forces and the indirect action of the will in directing attention, guiding interests, and developing habits of work.

PERSONALITY INVENTORY: A correlation between performance and results of the Neymann-Kohlstedt Introversion-Extroversion Test was worked out in this manner. The performance scores under subjective instructions were arbitrarily marked plus, and the scores under the objective instructions were marked minus. The difference between these two scores was then derived and compared with the inventory scores, the largest objective (minus) score being ranked first with the highest

extrovert score. Using the method of rank differences, the correlation between these two sets of scores was found to .074 ± .176, which is obviously insignificant. It seems that the aspect of personality measured by this inventory is not the important factor in the scores obtained in this experiment. More important factors seemed to be O's interpretation of and reaction to the instructions.

Certain questions on this inventory seemed to E to have special significance for this experiment. A further investigation of performance as compared with O's answers to these questions was attempted. The form of scoring that was used in the above correlation was again used here.

One of these questions is #49, which asks if O changes his opinion easily even when it is formed. Thirteen Os answered "yes" to this question, and their composite score on problem solving is 76, showing that they had somewhat altered their opinions in keeping with the instructions. Nineteen Os said "no" to this question, and their composite score on the problems is 210. Apparently they had altered their opinions at least to the extent of following the suggestions contained in the instructions, even more than those who answered "yes" to this question. However, they had not changed their opinions about the solution of the problems, and evidently had persevered in their erroneous hypotheses and took no clues from the various presentations of the problems. Still, this same habit should have given

them higher objective scores than they had.

A similar measure could be applied to Question 11, which asks if O accepts suggestions rather than working them out for himself. The sum of the scores of the nine Os who answered "yes" to this question is -8, showing that there is a slight tendency for this group to have higher scores under the objective instructions, and hence that they did not accept uncritically the suggestions offered in the instructions. The total scores of the twenty-three subjects who answered "no" to this question was 304, quite a high subjective score, which rather looks as though the subjective suggestions had been accepted and followed.

Another similar question (# 34) shows similar results. It asks if O acts on suggestions quickly rather than stopping to think. Thirteen Os answered "yes", and the sum of their scores is 41. If they really had acted on the suggestions given in the instructions, this total should have been much larger. Nineteen Os answered "no", and the sum of their scores is 207, which seems contrary to the opinion O expressed of himself. It is a known fact that man's estimate of himself is not always accurate. Robert Burns' oft-quoted line about seeing ourselves as others see us, is evidence of the truth of the above statement, as Burns is credited with extensive knowledge of human nature. Hence it is not wise to put too much weight on any self-appraisal test. Besides, the individual items

of a test do not usually have as high validity as the entire test has. Hence these results are not considered highly significant, but only interesting.

FURTHER QUALITATIVE DATA: Although this thesis has to do primarily with the quantitative data of the entire group, still in a psychological study it is not possible to lose the individual in the group, for the individual is really the subject of the study. Few more qualitative comments on this experiment should be added.

It has been remarked previously that some subjects were able to pick the "significant" lid each time because of a plan they had formulated from their notes, but were not able to make a general statement of their solution. This occurred in varying degrees with five different subjects. One of these subjects was able to give the correct statement after ten such presentations, and another one was successful after eleven presentations. The other three never did make the general statement, apparently being satisfied with their performance.

Five other subjects manifested performance which seems to be somewhat related to the above. These five Os spoke of having "hunches" in picking the correct lid, but the "hunches" did not help them consistently. They would pick the "significant" lid three or four times, and then for the next several presentations they would pick five or six lids at random. One of these Os said that she

was not even thinking when she picked the right lid, and gave the credit to her intuition. If we define intuition as unverbilized learning, this O was correct in her statement, as it was evident that partial learning had occurred. Another O, when asked why she had taken a particular lid, (the correct one) said: "My mind must be very funny. I don't know why I took this one." The others offered no comments, but merely said that they did not know why they had picked the correct lid. This type of performance was not confined to any particular problem, nor group of problems, nor to particular instructions.

Both of these types of performance seem to be somewhat similar to what Yerkes found in his study of ideational behavior. He writes:

In varying degrees, subjects are capable of explaining their solution of a given problem. At one extreme are found individuals who although capable of responding correctly and thus of meeting the technical requirements for the solution of their method or even of stating the relational problem which they have solved in motor terms. Individuals incapable of defining the right key appear among normal as well as among defective and pathological subjects (46:384).

Of course, the subjects of the experiment here being reported are all normal.

Interesting differences in attacking a new problem were noted. It seemed that the method of attack depended very much on the training and ability of the subject, especially for the very gifted subjects. Subject 31,

whose score on presentations tied for second place, but whose score on number of lids lifted was first, had a definite plan of attack for each new problem. If one problem ended near the left end, he started the next one from the right end. Although he had had no experience with this type of apparatus, he soon isolated the constant relationship. In contrast to this procedure the majority of the subjects showed little method in their attack of a problem or in their solution. This is evident from the fact that fifteen subjects failed to solve one problem, six failed to solve two, one failed to solve three, and one failed to solve four problems. This leaves only thirteen subjects, out of thirty-six, who were successful in all the problems, of whom six were psychology students, four were teachers, and three were untrained subjects. This indicates the advantage the psychology students had over all the others.

Interesting, but not significant, was the number of theories stated or indicated by the subject while at work. It would be more accurate to call O's remarks guesses, rather than theories for most of them seemed to relate to only the immediately preceding presentation, and bore no reference to previous presentations of the same problem. Among the subjects who performed this experiment, the number of theories, or guesses, often seemed to be an indication of the method used by O. Two extremes of this phenomena were evident. At one extreme were seven out of the eight having the lowest

scores, who offered no comments or theories while they were working. The method they used was efficient and scientific. They eliminated one variable after another, and when they found the constant relationship, they stated the correct theory. At the other extreme too many other factors were present to make this tendency to theorize significant. There was the unequal ability to verbalize, and with the greater number of presentations there was more time in which to verbalize. However, generally speaking, in this experiment, numerous guesses did not seem to correlate with successful induction. Using the method of rank difference, the correlation between performance and the ratio between number of guesses and performance (zero in guesses being coupled with best performance), is .42 .091. This seems to be similar to the guessing which Garth (18:29) comments on in his study of purposive thinking. He writes: "Too great speed in guessing is accompanied by ineffectual riddle solving." In this experiment it was not the speed of the guessing or theorizing that stood out, as much as its superficial nature. In this same connection, Dewey writes: "Too few suggestions indicates a dry and meagre mental habit. ... On the other hand, suggestions may be too numerous and too varied for the best interests of the mental habit. ... The best mental habit involves a balance between paucity and redundancy of suggestions" (12:36).

One of the most common errors found among the subjects

in this experiment was the persistence of erroneous assumptions. It seemed that some subjects reinstated an assumption if one presentation justified it, even though it had been entirely disproved by several previous presentations. Subject 27 was so sure that the relationship in Problem A III was to the uncovered boxes at the end, that when she could find no constant here, she wanted to give up. She was not successful in this problem. Similarly Subject 28 thought it was a relationship to the end of the box in Problem B III, but he found his mistake in ten presentations and was successful with this problem. Subject 34 showed by the lids she picked that she was looking for a pattern of alternating relationships from the two ends. As this continued with no success, she became very subjective, and made such comments as, "I feel awfully stupid taking so long." She finally succeeded on the twenty-third presentation of this problem (B III), while on the other five problems her total score was eighteen presentations. Subject 34 was sure that Problem A III had "something to do with ten", and made such a statement four times during the problem, every time that she could get a "ten" by multiplying, subtracting or dividing the numbers of "significant" compartments in successive presentations. She was not successful with this problem. Similarly Subject 22 was looking for arithmetical combinations, and Subject 24 was preoccupied with the uncovered boxes at the ends of the series. Subject 22 succeeded in 26 trials, and

Subject 24 was not successful.

This same phenomena has often been commented on by writers and experimenters in problem solving. Ruger writes: "Assumptions often had apparently volitional persistency, inversely proportional to amount of critical consideration given them" (39:17).

Besides the "volitional persistency" Ruger finds in this phenomena, there also seems to be some emotional elements involved. We like our brain children, the products of our own mental processes, and do not like to have to discard them. We seem to like them so well that we give them very little critical consideration, and apparently are not aware of the difficulties into which they lead us.

Maier in the conclusion of his report offers these suggestions in connection with this type of performance. He writes: "Because suggestions which advise against habitual and persisting activity increase problem solving ability, it is concluded that reasoning involves the inhibition of persisting habits as well as the ability to form solution-patterns" (31:155). These instructions were not a part of the technique of this experiment, so these habits persisted with some of the subjects.

CHAPTER V.

SUMMARY AND CONCLUSION.

This experiment was planned to investigate the influence on performance in problem solving of attitudes induced through verbal instructions. Two groups of problems designed to be of approximately equal difficulty were arranged to be used on an adaptation of the Yerkes' Multiple Choice Apparatus. To cancel out practice effect, inequality of difficulty of the two groups of problems, and the survival of previously induced attitudes, the experiment was arranged into four sub-groups. Thirty-six subjects completed the experiment.

When the scores of the entire group were used, significant differences were found in the number of presentations required for a successful induction under instructions designed to induce subjective and objective instructions. The instructions were also found to be effective in each of the four sub-groups, but varied in efficacy with the combination of difficult or ~~facilitating~~ factors, such as practice effect, and variable intrinsic difficulty of the two groups of problems.

Conspicuous factors which prevented a larger difference in the scores under the two types of instructions, were discovered from the comments of the Os while working on the problems, and from the answers of the Os to the questionnaire at the completion of the problems. Some of the important factors seemed to be the O's interpretation of

the instructions, and reactions to the instructions. Interesting differences in performance were noted and commented on.

A very insignificant correlation was found between performance scores and the scores on the Neymann-Kohlstedt Test for Introversiion-Extroversiion. Apparently the aspect of personality that is measured by this test was not important nor significant in performance in this experiment.

From this experiment we conclude that effective attitudes can be induced through verbal instructions; attitudes which can exert measureable influence on performance in problem solving. However, more effective instructions could be framed than those which were used in this experiment. By this we mean instructions that could not be misinterpreted. Secondly, a more effective method of presenting instructions could be arranged. Perhaps one method of doing this would be presenting the instructions in a progression with frequent repetitions of the important note of objectivity or of inferiority. However, it is scarcely possible for instructions to be so arranged and so presented that individual differences in interpretation of, and in reaction to these instructions, could be absolutely ruled out or prevented.

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APPENDIX I.

THE PROBLEMS USED IN THIS EXPERIMENT.

Here are presented ten arrangements for induction. Where more than ten were necessary the series was repeated in the same order.

Introductory Problems.

1. *

Relation to box: Lid No. 5.

Presentation.	Lids used.	Significant lid.
1.	1 - 6	5
2.	3 - 12	5
3.	4 - 6	5
4.	5 - 9	5
5.	2 - 10	5
6.	4 - 5	5
7.	4 - 10	5
8.	3 - 6	5
9.	1 - 8	5
10.	5 - 10	5

2. **

Relation to series: Second from right of covered boxes.

Presentation.	Lids used.	Significant lid.
1.	1 - 12	11
2.	2 - 7	6
3.	1 - 3	2
4.	7 - 11	10
5.	3 - 6	5
6.	4 - 10	9
7.	3 - 4	3
8.	1 - 8	7
9.	3 - 9	8
10.	1 - 5	4

2 X. **

Relation to series: Second from left of covered boxes.

(Used when "B" problems were presented first).

Presentation	Lids used.	Significant lid.
1.	1 - 12	2
2.	7 - 11	8
3.	3 - 9	4
4.	2 - 10	3
5.	10 - 11	11
6.	8 - 12	9
7.	4 - 9	5
8.	6 - 8	7
9.	9 - 12	10
10.	5 - 12	6

"A" Group of Problems.

1. *

Relation to series: First from left of covered boxes.

Presen- tation.	Lids used.	Signifi- cant lid.
1.	6 - 12	6
2.	11 - 12	11
3.	3 - 11	3
4.	1 - 5	1
5.	4 - 11	4
6.	10 - 12	10
7.	5 - 9	5
8.	2 - 12	2
9.	8 - 11	8
10.	7 - 12	7

2. **

Relation to box: Lid No. 7.

Presen- tation	Lids used.	Signifi- cant lid.
1.	1 - 12	7
2.	1 - 7	7
3.	6 - 11	7
4.	4 - 8	7
5.	2 - 10	7
6.	1 - 8	7
7.	5 - 9	7
8.	7 - 12	7
9.	6 - 7	7
10.	3 - 10	7

3. *

Relation to middle of series: Left of middle compartment.

Presen- tation.	Lids used.	Signifi- cant lid.
1.	6 - 12	8
2.	3 - 5	3
3.	8 - 12	9
4.	1 - 9	4
5.	2 - 12	6
6.	10 - 12	10
7.	5 - 11	7
8.	1 - 5	2
9.	3 - 9	5
10.	1 - 3	1

"B" Group of Problems.

1. *

Relation to series: Third from right of covered boxes.

Presenta- tion.	Lids Used.	Signifi- cant lid.
1.	1 - 6	4
2.	5 - 8	6
3.	3 - 12	10
4.	1 - 3	1
5.	7 - 11	9
6.	2 - 10	8
7.	1 - 7	5
8.	2 - 4	2
9.	2 - 9	7
10.	1 - 5	3

2. *

Relation to box: Progression from right to left.

Presenta- tion.	Lids used.	Signifi- cant lid.
1.	10 - 12	12
2.	6 - 12	11
3.	3 - 10	10
4.	8 - 12	9
5.	8 - 10	8
6.	1 - 9	7
7.	5 - 8	6
8.	4 - 9	5
9.	2 - 11	4
10.	3 - 7	3

3. *

Relation to middle of series: Right of mid point.

Presenta- tion.	Lids Used.	Signifi- cant lid.
1.	3 - 10	7
2.	1 - 4	3
3.	2 - 7	5
4.	1 - 2	2
5.	3 - 12	8
6.	8 - 11	10
7.	5 - 12	9
8.	1 - 10	6
9.	1 - 6	4
10.	11 - 12	12

* Problems taken from Yerkes' list of Suggested Problems (46:392).

** Problems arranged for this experiment by the experimenter.

The Neymann-Kohlstedt Diagnostic Test for Introversion-Extroversion

(1928 Revision)

Name..... Occupation..... Age.....

This test is composed of fifty statements, each being followed by the words "Yes" and "No." There is no implication of right or wrong in any of the statements and you are asked to consider them from the viewpoint of personal like or dislike. Read the first statement and if you like the idea it expresses, draw a line under "Yes." If you dislike it, draw a line under "No." Proceed in the same way with the rest of the statements.

- | | | | |
|--|-----|----|----|
| 1. Be by yourself a great deal | YES | NO | 1 |
| 2. Think of life in terms of pleasure | YES | NO | 2 |
| 3. Always be calm and collected | YES | NO | 3 |
| 4. Have a great deal of confidence in others | YES | NO | 4 |
| 5. Think or dream of what you will do five years from now | YES | NO | 5 |
| 6. Stay at home during a social affair. | YES | NO | 6 |
| 7. Work with many people around you | YES | NO | 7 |
| 8. Do the same kind of work all the time | YES | NO | 8 |
| 9. Enjoy social gatherings just to be with people | YES | NO | 9 |
| 10. Think a great deal before deciding anything | YES | NO | 10 |
| 11. Accept suggestions rather than working them out for yourself | YES | NO | 11 |
| 12. Quiet rather than exciting amusements | YES | NO | 12 |
| 13. Dislike having people watch you | YES | NO | 13 |
| 14. Quit a tiresome task | YES | NO | 14 |
| 15. Save money rather than spend it | YES | NO | 15 |
| 16. Seldom (infrequently) analyze your thoughts or motives | YES | NO | 16 |
| 17. Indulge in reverie (day-dream) or thought | YES | NO | 17 |
| 18. Have people watch you do things that you do very well | YES | NO | 18 |
| 19. Let yourself go when angry | YES | NO | 19 |
| 20. Work better when people praise you | YES | NO | 20 |
| 21. Have excitement | YES | NO | 21 |
| 22. Often meditate and think about yourself | YES | NO | 22 |
| 23. Be a leader at a social affair | YES | NO | 23 |
| 24. Speak in public | YES | NO | 24 |
| 25. Do the things that you dream about (day-dream) | YES | NO | 25 |
| 26. Rewrite social letters | YES | NO | 26 |
| 27. Get things done very quickly rather than being slow and sure in movement | YES | NO | 27 |
| 28. Think a great deal | YES | NO | 28 |
| 29. Be able to express your keenest feelings (joy, sorrow, anger, etc.) | YES | NO | 29 |
| 30. Pay little attention to details | YES | NO | 30 |
| 31. Be exceedingly careful in meeting people | YES | NO | 31 |
| 32. Associate freely with people holding views opposed to your own | YES | NO | 32 |
| 33. Puzzles | YES | NO | 33 |
| 34. Act on suggestions quickly rather than stopping to think | YES | NO | 34 |
| 35. Read about rather than do a thing | YES | NO | 35 |
| 36. Enjoy the story more than the way it is written | YES | NO | 36 |
| 37. Keep a personal diary | YES | NO | 37 |
| 38. Keep quiet when out in company | YES | NO | 38 |
| 39. Act on the spur of the moment | YES | NO | 39 |
| 40. Dislike thinking about yourself | YES | NO | 40 |
| 41. Always plan out work before you begin it | YES | NO | 41 |
| 42. Change from one type of work to another frequently | YES | NO | 42 |
| 43. Avoid trouble rather than face it | YES | NO | 43 |
| 44. Believe that rumors are important | YES | NO | 44 |
| 45. Confide in others | YES | NO | 45 |
| 46. Distrust people you have just met until you get better acquainted | YES | NO | 46 |
| 47. Study others rather than yourself | YES | NO | 47 |
| 48. Spend your vacation at some quiet place rather than at a lively resort | YES | NO | 48 |
| 49. Change your opinions easily even when formed | YES | NO | 49 |
| 50. Take an active part in all conversations going on around you | YES | NO | 50 |

No. Right..... No. Wrong.....
Score Rt..... Minus Wr.....