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# PROBLEM-SOLVING RIGIDITY AND FAILURE EXPECTANCY

by

George Howard

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

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George Howard

New York City

June, 1971

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## Preface

The concept of rigidity has long been a major concern in the study of human behavior. Psychoanalysts (as cited by Luchins and Luchins, 1959), whatever their specific emphasis, dealt with the broad concept and attributed to it some defensive quality. Goldstein (1943), working with organically impaired and mentally deficient individuals did the same. In fact, most theorists concerned with abnormal behavior or human development (e.g., Kounin, 1941; Werner, 1946, etc.) have dealt with rigidity in some way.

In the 1940's, the concept was introduced into the study of normal problem solving behavior by Luchins (1941). A long controversy raged in the psychological literature through the 1950's, largely through a series of articles by Luchins and Rokeach (see below) as to whether Einstellung rigidity, as measured by Luchins' Water Jar Test, was a situationally determined phenomenon or a reflection of a personality characteristic. The evidence was equivocal, and the controversy was never really resolved, although the personality characteristic point of view tended to be most widely accepted (Daniel Katz, personal communication).

In preparing for previous research, the present writer was struck by the defensive quality generally attributed to rigidity. Further, while individually testing subjects classified as rigid according to Luchins' test, behavior quite similar to that described by Sassenrath (1964) as characteristic of the test anxious individual was observed. This led to a study (Howard and Slatus, 1966) in which it was demonstrated that rigids are significantly more test anxious than non-rigids. Atkinson (1964) and others working in achievement motivation have indicated that test anxiety is an index of the motive to avoid failure.

The question is then raised as to whether people would characteristically seek to avoid failure in the problem solving situation unless they _expected_ to encounter it. Further, the above reported finding suggests a relationship between problem solving rigidity and the motive to avoid failure.

It is the purpose of the current research to explore a possible causal relationship between rigidity in the problem solving situation and the expectancy of failure in such a situation, and, concomitantly, the use of a rigid problem solving approach as a defense against such anticipated failure.

## Introduction: History of Rigidity

Chown (1959) and Leach (1967) in their thorough reviews of the literature on rigidity through the 1960's both come to the conclusion that there is no single concept of rigidity and that different tests of rigidity have been, in actuality, measuring different things.

Much of the work relating cognitive rigidity to personality characteristics has been in the area of problem-solving rigidity, and has made use of the Luchins' (Luchins and Luchins, 1959) Water Jar Test as the initial measure of rigidity. This measure, and the theoretical material relating to it, will be used in the current investigation. The designation of individuals (or groups) as rigid and non-rigid throughout this paper will refer to extreme scorers on the rigidity continuum (see below), as measured by performance on the Water Jar Test.

There have been two major branches of research utilizing the Einstellung effect. One, represented by Luchins (1951a, 1951b, 1959) has sought to study experimental manipulations that will vary the amount of Einstellung behavior manifested by the subjects. This research reflected a view of Einstellung rigidity as situationally determined. The other branch, represented by Rokeach (1948, 1949, 1950, 1951a, 1951b, 1951c, 1960), has studied individual personality differences between those who do and those who do not, under similar experimental conditions, manifest the Einstellung effect.

There is much written on rigidity by psychoanalysts (see Luchins and Luchins, 1959) and others who have been concerned with pathological conditions (e.g., Goldstein, 1943, Kounin 1941a, 1941b, 1948, Werner, 1946b) all of which seems to have the common denominator of attributing some defensive, ego-protective quality to rigidity, whatever the author's specific conceputalization of rigidity may have been. The conception of rigidity in the problem-solving situation as being defensive in function is of central concern in the current investigation.

Leach (1967) bases most of her theoretical analysis of rigidity on Frenkel-Brunswik's psychoanalytically oriented study of the authoritarian personality. According to Leach, Frenkel-Brunswik defines "... rigidity as a fundamental restriction on the individual's perception of his environment, and therefore of the use which he could make of that environment ..." (p.18). Rigidity is presented as a defense against Ego-threat, the development of which is seen as relating to the type of parent who produces a rigid child. Such a parent is seen as teaching the child, in a setting of required submission to and obedience to authority, dichotomies such as cleanliness-dirtiness, goodness-badness, etc. The child could neither understand nor achieve the demands made upon him by his parents, and could obtain parental approval only through the rote learning of the specific kinds of behavior required of him. Such a child is seen as learning to subdue rather than to control or channel his impulses. "... And, he learned to subdue them without comprehension: in obedience to external demands rather than to internalized standards. This perilous structure of social learning, with no foundation in internal values, could only be supported by a rigid system of defenses within the self, with black and white as recognizable and manageable dichotomies, and grey the color of threat. The threat of ambiguity ..." (p.18).

Thus, such children would never learn to search the world for alternatives. Without comprehending anything but over simplified dichotomies they would be out of touch with the freedom to experience and judge for themselves. They would <u>expect</u> to fail if they deviated from the prescribed pattern of responding and, in fact, such deviation would be viewed as failure in the eyes of the parents, with the usual emotional consequences.

The current research attempts to relate problem-solving rigidity to just such failure-expectancy in the problem-solving situation. The prevalence of cognitive rigidity in academic circles (in a given group of college Ss, Einstellung-rigids generally outnumber non-rigids) may be, in the above theoretical context, traced to the equations drawn in our culture between academic achievement and success as a person and academic failure and failure as a person (which carries with it the dire consequences of disapproval, rejection, etc.) Thus, in terms of Frenkel-Brunswik's theory, the dichotomous approach - - success-failure vis-a-vis acceptance-rejection - - may then be generalized, becoming a characteristic mode of dealing with achievement-oriented situations, with the approach of constantly searching the world for alternatives becoming obliterated because alternatives to the "tried and true" are the grey between the black and white that are perceived as threat. Such children are having communicated to them that to leave the safe and sure will lead to failure, i.e., that they are not equipped to deal with problems innovatively, and so they stick with something which works, when they find it, not daring even to consider that there might be a better or easier way of reaching their goal. Problem-solving rigidity, then, may be a manifestation of the child's coming to feel that were he to attempt anything on his own, he would fail. Although rigidity-non-rigidity is seen as a personality characteristic, behavior related to such a cognitive organization is seen as situationally modifiable. This will be discussed at length in the discussion section below.

The study of problem-solving rigidity began with Luchins and his water jar problems in 1942. This test dealt with a series of simple mathematical problems, involving the measurement of specific amounts of water given an unlimited water supply and three hypothetical jars of known capacities. Several problems were presented to establish a mental set - - Einstellung - - all of which were soluble by the same method (Jar B - Jar A - 2 Jar C). Subsequent critical problems could be solved by this method, but also by a shorter, more direct method (e.g., A - C), while extinction problems could be solved only by the short method. It has consistently been Luchins' view that Einstellung rigidity is dependent upon the formation of strong, blinding mental sets, and that such rigidity is strictly a situational phenomenon, varying with changes in experimental procedure.

Rokeach (1948, 1949, 1950, 1951a, 1951b, 1951c, 1960), on the other hand, concluded that Einstellung rigidity reflects a personality characteristic rather than a situational phenomenon. Thus, using the Water Jar Test he related Einstellung rigidity to such personality characteristics as ethnocentrism, prejudice, and concreteness of thinking.

Luchins (1949) criticized Rokeach's conception of rigidity, holding that it is purely a situational phenomenon. For example, Luchins found that putting a time limit on his Ss increased the frequency of the Einstellung effect. Luchins did not take into account, however, the fact that under whatever experimental conditions he imposed, there were still Ss who did not adhere to the Einstellung method. Although situational factors may play a role (e.g., pressure causing a borderline non-rigid to score rigid), it would seem to follow that there must be something in the personalities of some individuals that enables them to shift set and that differentiates them from others who maintain set blindly under the same objective conditions.

Rokeach (1948) defined rigidity as the inability to shift sets when objective conditions demand such a shift. Luchins (1949) criticized Rokeach, stating that critical problems on the Einstellung test do not demand such a shift, since they are still solvable by the long method. He stated, further, that this was particularly true when time pressures were put on S. These contentions were supported by Levitt, 1956, and Levitt and Zelen, 1953 and 1955, who stated, further, that under such conditions adherence to the Einstellung method might be more efficient. Those objections are sound, but again raise the same question: if objective conditions do not demand a shift, why are there individuals who shift and what differentiates them from those who do not?

Rationale for the Current Research

Rokeach (1960, p. 185) using the Gough-Sanford Rigidity Scale to set up rigid and non-rigid groups, established the Doodlebug Problem as a measure of rigidity. He defined rigidity as an impairment of analytic thinking which prevents the breaking down and overcoming of beliefs which are no longer appropriate to a situation, and prevents replacing them with new beliefs, more appropriate to the situation. Howard (1962) used the Doodlebug Problem and Water Jar Test in an attempt to demonstrate that the Einstellung Test is a measure of a general approach to problem-solving. Rigidity in the problem-solving situation was defined as "... a closedness to the seeking of new possibilities ... an unwillingness to look for new alternatives ..." (p. 2). Rigid and non-rigid groups were established based on their performance on the Einstellung Test. Extreme scorers, in terms of the number of critical problems solved by the Einstellung method, constituted the groups. The higher the score, the more rigidity. The members of each group were tested with the Doodlebug Problem in individual sessions. The score on this task was the number of necessary beliefs overcome without help, and therefore, the <u>higher</u> the score the <u>less</u> rigidity. The prediction was a negative correlation between the two tests, since a high score on the Water Jar Test should correspond to a low score on the Doodlebug Problem. A product-moment correlation between the two tests was computed and was found to be -.71, confirming that those who solve critical problems by the Einstellung Method on the Water Jar Test were likely to overcome significantly fewer beliefs on the Doodlebug Problem. Thus, Einstellung rigidity was found to be predictive of rigidity in a problem-solving situation utilizing a dissimilar task, which lends support to the contention that Einstellung rigidity reflects a characteristic (rigid) approach to problem solving.

Further support is given to this contention by the ruling out of intellectual factors as accountable for obtained differences between rigids and non-rigids (at least in a college population). This lack of intellectual differences was reported by Rokeach (1960). Howard and Slatus (1966), in a pilot study generally attempting to relate Einstellung rigidity to behavior in social situations, included the vocabulary subtest of the WAIS in their test battery. They found no difference in intelligence between their rigid and non-rigid groups. Further, in a pilot study done prior to the present writing (Howard, 1969), the Information subtest of the WAIS (the subtest which correlates most highly with the WAIS Full Scale I.Q., Wechsler, 1957) was correlated with the Water Jar Test. The product-moment correlation was found to be $r=.15$, $p > .20$. This line of evidence would appear to rule out intellectual differences as capable of accounting, to any large extent, for rigidity in the college population.

Returning to Howard's 1962 study, even more important than the statistical findings, in terms of the current research, were some qualitative observations made which were similar to observations made by Rokeach (1960). Howard reports that rigid subjects, when tested individually, were noted to be passively aggressive toward the examiner and to be more aggressive toward the testing situation and toward themselves, than were the non-rigids; to be quite defensive, to frustrate easily, and to need encouragement in order to sustain effort toward completing a task. He concluded that rigids have low confidence in themselves and in their ability, that they frustrate easily, and that they make many self-deprecating remarks, while non-rigids work with sustained attention and confidence. These findings point to basic personality differences between rigids and non-rigids, at least in an achievement-oriented problem-solving situation. (Howard and Slatus, 1966, in the study mentioned above, demonstrated that the Einstellung-defined rigid person manifests behaviors similar to those described above in his social interaction as well.)

Most important for the current investigation is the similarity between the above description of the behavior of the rigid person and Sassenrath's (1964) description of high test-anxious Ss as "... characterized by irritability, emotionality, apprehension, and general lack of confidence and self-assurance." (p. 371). Sassenrath stated, further, that this test anxiety factor was consistently unrelated to measures of intelligence, special abilities, etc. (as was found for rigidity, see above). Howard and Slatus (1966) found rigids and non-rigids not to differ in intelligence, social intelligence, group conformity, or willingness to be honest about themselves, but found them to differ significantly in Test Anxiety ($p < .025$).

The Test Anxiety Questionnaire (TAQ), used by Howard and Slatus (1966), has been widely and successfully used in achievement motivation research as the measure of the motive to avoid failure ($M_{af}$). In fact Weiner (1970) found the TAQ used alone to be no less accurate in establishing $M_{af}$ and $M_s$ groups than is the commonly used combination of the TAQ and the Thematic Apperception Test (TAT), although

Atkinson (1964) had previously indicated that independent measurement of the two motives was necessary.

In general, then, people who score high on the TAQ (a self-report questionnaire designed to relate specifically to anxiety in the achievement situation) are characterized as having a stronger motive to avoid failure than are low test-anxious people. Since rigids have been shown (Howard and Slatus, 1966) to have higher TAQ scores than non-rigids, it would appear, in the light of the achievement motivation literature (particularly Weiner, 1970) that they also have a stronger motive to avoid failure than do non-rigids. The question then raises itself: why does a person have, as a characteristic of his personality in achievement-oriented situations, a high motive to avoid failure? A logical answer would seem to be that a person seeks to avoid failure <u>because he expects to encounter it</u>. (The achievement motivation literature (see below) generally makes references to fear of failure with regard to $M_{af}$. However, the same logic applies: why would a person consistently enter achievement situations with a fear of failure unless he <u>expected</u> to encounter failure?)

This line of reasoning leads to the major concern of the present investigation: given the above findings, it is suggested that rigidity in the problem-solving situation is related to expectancy of failure in such situations.

The relationship will be investigated by interpolating success-failure expectancy conditions between two equivalent forms of the Water Jar Test (see Method section). Specifically, a measure of initial confidence, Probability Estimate i ($PE_i$) will be taken (Feather, 1969). This will be followed by administration of the first Water Jar Test (EI), with subjects asked to estimate their probability of success (PE 1-10) on each problem before they see it (Feather and Saville, 1967). Next, Ss will take an Anagrams Test which will be used to manipulate success and failure (see Method section). An Anagram Test is being used to increase generalizability of the importance of the failure experience, (were an arithmetic task used, it could be argued that any effects obtained were due to specific anxiety surrounding mathematics). Probability Estimates will be obtained for each of the Anagram Test items as well as for each problem in the second Water Jar Test (EII), which follows the success/failure manipulation.

The theory being tested predicts that rigids will show lower initial confidence than non-rigids. Further, while it is likely that all people have a general conception of their ability in a given achievement situation, the rigid person is less likely to modify his expectation of success (or failure) from task to task based upon experience than is the non-rigid (i.e., the success experience and anticipated future success will not serve to raise the rigid's confidence). Additionally, the rigid person, as herein defined, is conceptualized as an individual whose mode of functioning in the problem-solving situation is consistently one of sticking to something that works without being open to alternatives, as a defensive approach geared toward the avoidance of expected failure. It would follow that anyone may function rigidly in a given situation, provided that failure expectancy is aroused. Finally, if rigidity is indeed defensive, and the rigid behavior proves successful, the individual's estimate of his probability of success should increase following success within a given task wherein the rigid approach is successful. Thus, the non-rigid should alter his expectancy of success, based upon experience, both from task to task and within tasks, while the rigid should not alter his expectancies from task to task, but only within tasks wherein his rigid approach has proven successful. If this is borne out, it will be demonstrative of the defensive nature of problem-solving rigidity.

**HYPOTHESES**

The above theory generates the following hypotheses, to be tested in this investigation:

Hypothesis 1. a) Rigid Ss, as established by their performance on EI, will solve significantly more critical problems by the Einstellung method on EII than will non-rigid Ss. b) Where failure expectancy is experimentally induced in the non- rigid, there will be no significant difference between the rigid and non-rigid Ss in the number of critical problems solved by the Einstellung method on EII. (The statistical prediction, then, is that there will be a significant rigidity condition interaction such that the groups will differ following success expectancy induction, but not following failure expectancy induction.)

Hypothesis 2. Rigid Ss will have a significantly lower expectancy of success (lower initial confidence), prior to beginning the first task, than will non-rigid Ss.

Hypothesis 3. The rigid Ss will show significantly less change than the non-rigid Ss in their expectancy of success estimates from task to task (EI to the Anagram Test), prior to experimental manipulation, as measured by the difference between the initial confidence score and the average of the probability of success estimates for problem 1 of EI and problem 1 of the Anagram Test ($PE_i - \frac{PE(EI_1) + PE(A_1)}{2}$).

Hypothesis 4. a) Rigid Ss will show a higher Probability of Success Estimate for the average of problems 8, 9, and 10 than for problem 1 of both Water Jar Tests. b) The non-rigids will also show a higher estimate of success probability for the average of problems 8, 9, and 10 than for problem 1 of both Water Jar Tests. Their difference will be based upon reaction to experience, rather than on defensiveness, which will be shown by the difference in <u>approach</u> taken by the two groups. (If hypothesis 1 is confirmed, the approach on EII should not differ for the two groups under failure expectancy conditions.)

A series of exploratory analyses will also be performed.

<u>Exploratory Analyses</u>:

1. Feather (1969) points out sex difference in initial confidence, with females giving lower estimates. Further, Atkinson (1964) points out that due to their erratic behavior, The Achievement Motivation model could not be used with females. Therefore, in the current investigation, the existence of sex differences will first be determined. If none are found, data for both sexes can be taken together. If there are sex differences, only male <u>S</u>s will be used for the final sample, the data for females being held for exploratory analysis for future research. The use of male <u>S</u>s to the exclusion of females has its precedent in previous research, as indicated above.

2. The design of the experiment (see below) will include in the final experimental groups extreme scorers on the rigid-

ity continuum who are unfamiliar with the task, and for whom the success/failure manipulation has been successful. The data of those Ss for whom the procedure was unsuccessful will be explored, with no hypotheses being offered concerning their performance.

3. These are several somewhat overlapping areas of current research interest which have relevance to the present investigation. These areas will be briefly summarized, and the data yielded by the current experiment will be explored for questions they might raise for future study along these research lines. Broadly, these areas of research interest can be listed as a) Achievement motivation, b) Success/Failure and Expectancy, and c) Attribution. Although an attempt will be made to present them separately, some overlap will be evident.

a) Achievement Motivation:

Atkinson (1964) reviewed his resultant achievement motivation model, adding to it the concept of extrinsic motivation to account for the fact that people in whom the motive to avoid failure is greater than the motive to succeed ($M_{af} > M_s$) frequently enter into achievement-oriented activities. Feather (1968), reviewing the literature on achievement motivation with regard to the attractiveness of success and the repulsiveness of failure reports a study in which he finds these valences to vary with the degree to which S can attribute responsibility for the outcome of his performance to his own ability. As a result, Feather suggested including a multiplicative factor, C, perceived locus of control, into the mathematical model of achievement motivation. Weiner (1970) reported on a 1964 study of persistence by Atkinson and Cartwright. These authors further extended the achievement motivation model by adding a factor of "inertia". This concept holds that an aroused goal-directed tendency continues until the goal is attained. Thus, the tendency to act is a function of the current situation plus the aroused but unsatisfied inertial motivation. This would seem to imply increased achievement activity following failure (i.e., non-attainment of goal). Weiner reports on a study of his own in 1965 wherein those in whom $M_s > M_{af}$ persisted longer and worked faster following failure, confirming the model, while those in whom $M_{af} > M_s$ persisted longer and worked harder after success, which does not support the extended model. Weiner's contribution was to suggest that the inertial tendency is itself a resultant of approach and avoidance (i.e., avoidance of the threat of continued failure) components. This would account for the results reported above since failure would arouse approach inertia in $M_s > M_{af}$ and avoidance inertia in $M_{af} > M_s$.

Weiner (1970) reports two studies designed to test the extended model, one a study of free choice of achievement tasks following (manipulated) success and failure, and the other of persistence. Both studies gave general support to the extended (inertial) achievement motivation model, with results falling generally between the .05 and .001 levels of significance.

Weiner's (1970) findings afford some further explanation of previous results. Thus, Karabenick and Youssef (1968), using the TAT to measure $M_s$ and the TAQ to measure $M_{af}$ verified the most universally supported prediction of the original Atkinson model, i.e., the preference and superior performance of $M_s > M_{af}$ people at tasks of intermediate difficulty. Feather and Saville (1967) also used the TAT and TAQ to set up $M_s$ and $M_{af}$ groups, showing that the amount of prior success and failure is an important determinant of subsequent performance and that failure experiences affect probability of success estimates and performance more than do success experiences. (Significance levels fell generally between .05 and .01). Weiner's suggestion that <u>both</u> inertial motivation, defined as a resultant, and extrinsic (non-achievement oriented) motivation must be included to account for the data appears sound. (An important implication for the present study's rationale is Weiner's (1970) finding that the TAQ did as well or better than the TAT-TAQ combination in establishing motive groups.)

The material presented so far has been largely empirical. Weiner and Kukla (1970) have posited a theory of achievement motivation based upon attribution of causality, which follows from the suggestion made by Feather (1968) mentioned above. While the six studies reported by the authors in this paper are a bit weak, dealing with attributions of causality for the performance outcomes of <u>others</u> rather than for attributions concerning one's own performance (which makes a difference, e.g., see Jones, et al, 1968, summarized below), their attempt at positing a cognitive mediator of achievement-oriented behavior may have an important relationship to the expectancy dimension being dealt with in the current investigation. In their first two experiments they demonstrate that greater reward is given for effort than for ability ($p = .001$, generally), although both are within the realm of internal control, using high school and college student raters. In Experiment III, they used student teachers as <u>S</u>s, getting the same results ($p = .001$). The authors conclude, "... Across three subgroups there were significant main effects of outcome and motivation, and a trend toward a main effect of ability which was of lesser magnitude than that of motivation ..." (p. 5). A further important finding is that shame is most experienced when the performer has ability ($p = .001$). Most important, external reward is consistent with subjective pride following success, but is consistently higher than subjective pride over moderate success or shame for any failure. The authors write, "... the negative affect given unfavorable outcomes is more severe than others may think it ought to be ... the possibility exists that external punishment for failure really has little negative reinforcement value in achievement-related contexts, for one's internalized self-punishment system is probably more salient, more efficient, and more cruel ..." (p. 7). This is consistent with Feather and Saville's (1967) finding that failure is a more potent subjective experience than is success.

This finding led to a further study designed to test two hypotheses: 1) Ss high in resultant achievement motivation are more likely to attribute success internally than are Ss low in such motivation, and 2) Ss low in resultant achievement motivation will internally attribute failure and will experience more shame than will Ss high in such motivation. Hypothesis 1 was confirmed, while 2 was not.

The fifth experiment ($p$ ranging from .1 to .001) showed generally that people with high resultant achievement motivation internalize success while those low in such motivation externalize success. This study also appeared to suggest that those low in achievement motivation internalize responsibility for failure.

As a result of experiments IV and V the authors, moving toward a theory of achievement motivation, state that the cognitive mediator $M_s$ is an internal attribution for success. Experiment VI was designed to show that the variables of achievement motivation theory, $P_s$, $I_s$, $P_f$ and $-I_f$ can be conceptualized in attribution theory.

Most people, according to the authors, succeed at an easy task and fail a hard one. Thus, success and failure may be externally attributed, i.e., <u>to the task</u>. This external ascription leads to little pride or shame. The final study tests the hypothesis that $P_s$ (subjective probability of success, a measure of task difficulty) and internal attribution will be linearly related within success and failure outcome conditions. This was confirmed ($p = .001$). Internal attribution for success increased as the task became harder, while internal attribution for failure increased as the task became easier. There was also a greater overall tendency for internalizing success ($p = .05$). (This argument has the weakness of the authors writing of self-attribution when in fact their <u>S</u>s judged the achievements of others in an artificial situation.) The authors contend that there is more pride ($I_s$) with success at a hard task and more shame for failure at an easy task, because, respectively, there is greater self-attribution for success at a low $P_s$ (hard) task and greater self-attribution for failure at a high $P_s$ (easy) task.

The authors summarize their attribution theory explanation of traditional achievement motivation findings as follows:

1) The high need-achievers are more likely to approach achievement-related activities because they ascribe success to themselves and therefore get greater reward than do low need achievers.

2) The high need-achievers will persevere longer in the face of failure than will the low need achievers because they will ascribe failure to a lack of effort rather than a lack of ability.

3) High need-achievers choose tasks of intermediate difficulty because performance on such tasks is more likely to yield information about one's ability than are very easy or very hard tasks.

This theory was presented in detail because it is hoped that exploration of the expectancy data collected in the current study may suggest a re-interpretation of the findings in the form of an expectancy-mediator model of achievement motivation. This will be returned to in the discussion section.

For closure, another recent elaboration of the theory of achievement motivation will be presented (Raynor, 1970; Raynor and Rubin, 1971).

Raynor's elaboration adds a future dimension, i.e., there are important effects of expected future outcomes on the strength of motivation for the task confronting an individual in the present. Each expected success or failure in a "contingent path" is assumed to arouse a component tendency to achieve success and avoid failure respectively. These component tendencies summate so that motivation for the current task (in a contingent path) is a function of both future and immediate expected successes and failures when the activity is the immediate next step in a contingent path.

A student with $M_s > M_{af}$ should be more motivated to achieve and should get a better grade when that grade is seen as related to future career success. Extrinsic motivation should further enhance this. A student with $M_{af} > M_s$ should be more inhibited and hence receive a lower grade under contingency conditions, unless inhibition is overcome by extrinsic motivations. Two studies were done, each using the TAT and TAQ to set up achievement groups, to test the above propositions. The predictions were generally supported, with the added finding that $M_s > M_{af}$ got lower grades where courses were not seen as important for future career success. This led Raynor to suggest that a student's characteristic pattern of achievement motivation is revealed only when there is future contingency.

Raynor and Rubin's (1971) study was designed to test the same general theory. In this study, future orientation was directly manipulated by inducing contingent and non-contingent paths. $P_s$ was set at .50, and performance level was measured on the first test in each experimental condition. Results showed the $M_s > M_{af}$ group to attempt and succeed at more problems than did the $M_{af} > M_s$ group, with the differences greater in the contingency condition. The results confirmed the hypotheses that $M_s$ would perform better in contingency than in non-contingency while $M_{af}$ would perform worse in the contingency than in non-contingency and that people in whom $M_s = M_{af}$ would perform the same in both conditions.

The general history of achievement motivation theory has been presented in some detail because of a) the relevancy of some of its findings and methodology to the rationale of the current study and b) the possibility that the present study will provide some data which will further the understanding of achievement motivation. This topic will be returned to in the Discussion section of this paper, as attention is now turned to the general areas of Success/ Failure and Expectancy.

b) Success/Failure and Expectancy:

Feather and Sayville (1967) report a study by Feather in 1966 which dealt with the effect of prior success and failure on subsequent performance and on estimates of probability of success. Those who succeeded subsequently did better at the same task, while those who failed did worse. Probability of success estimates increased following success and decreased following failure, the shift in probability estimates being greater after failure than after success. The 1967 study sought to investigate the same variables in terms of the amount of prior success and failure. High expectancy and low expectancy groups were established. Ss were then presented with an Anagrams task wherein amount of success and failure and subsequent success and failure could be manipulated. The findings generally replicated those of the 1966 study, again with failure having a greater affect on expectancy changes than did success. The authors also found that the greater the initial amount of success and failure, the more generalized (persistent) its consequences on subsequent performance. The less the initial amount of success and failure, the more its effect dissipates as S later works on, respectively, harder or easier tasks. Another important finding concerning the relative potencies of success and failure experiences was as follows: "... Apparently prior failure results in both higher anxiety about performance and a more rapid development of anxiety about performance than does prior success ..." (p. 231). Further, expectancies change more and reported anxiety and disappointment increase as the amount of failure increases. Thus, the findings of Feather and Saville (1967) show generally that prior experience affects subsequent performance, that the amount of success or failure experience is important in determining subsequent performance, and, perhaps most importantly, that failure has a much more profound influence on subsequent expectancies and performance than does success.

Foxman and Redtke (1970) did a study which shows the general importance of expectancy, although it deals, not with problem solving or success/failure, but with choice of an aversive task. They report a study by Aronson, et al, in 1963 which showed that if S expected an aversive task, he later chose it over a non-aversive task. The explanation invoked was that adaptation took place between expectation and choice. The authors studied this by varying the interval and activities engaged in between expectancy and choice. They obtain general support for their adaptation theory. Thus, what S expects, and how he is able to mediate his expectations cognitively, is seen as having an effect on subsequent choice behavior. This may have implications for, e.g., achievement-motivation theory wherein individuals have been differentiated on the basis of their choice behavior (choice or avoidance of $P_s$ = .5 etc.). The results must be taken cautiously, however, since the authors did not control for such variables as acquiescence, desire not to appear cowardly, etc., and inferred rather than measured the presence of anxiety.

Isen (1970) presents two studies designed generally to demonstrate that success experiences generalize to produce more congenial social behavior. The author gained support, through questionable measures (e.g., having a can placed on a table, asking for donations, during the study, without determining if Ss saw it as part of the study; using as a criterion variable whether S liked a stranger who walked through the room, in general, ~~she~~ treating her Ss as unnecessarily naive.) of her contention that success leads to increased social interaction, helpfulness, etc., but does not gain support for the contention that failure produces hostility and reduces social interaction.

Jacobson et al (1970) did a study of cheating behavior during a failure experience which has some relevance to the quality of defensiveness being explored in the current investigation. The authors related such variables as sex, expectancy of success, need for approval, self-satisfaction, and social desirability to cheating during a failure experience. The major findings were: 1. Women are found to cheat while men are not. 2. The high self-satisfied cheated while the low self-satisfied did not. 3. Findings 1 and 2 were due largely to the group of high self-satisfaction females. 4. Ss high in both self-satisfaction and need for approval cheated. 5. Women high in need for approval cheated. 6. Ss high in expectancy of success cheated, while Ss low on this measure did not. 7. Men had higher expectancies of success and levels of aspiration than did women. 8. Those higher in Social Desirability were higher in expectancy of success. 9. Those high in need for approval were higher in expectancy of success.

These results generally point to defensively high expectancy of success reports by those strong in Social Desirability, need for approval, and other measurements of defensiveness (including cheating). They may have important implications for hypotheses 2 - 4 of the present study, which deal with initial confidence and expectancy of success estimates.

As the authors conclude: "These results support the hypothesis that NA (need for approval) scores represent defensive behavior resulting from an intense concern with avoiding failure in an interpersonal situation ... These results suggest that subjects scoring high on both NA and self-satisfaction are those who perceive their lives as successful but who have maintained an unusually strong fear of social disapproval and failure ..." (p.55). The authors also see their results as consistent with the interpretation of low social desirability scorers as people willing to risk being seen as less socially desirable. This suggests that high social desirability scores are defensive.

As stated above, these results may prove important for interpreting the expectancy data obtained during the current investigation.

Kates and Barry (1970) did another study which bears on the defensive problem-solving behavior of the failure-avoidant subject.

The authors suggest that a high failure-avoidant person might anticipate failing in a problem-solving situation and so might tend to avoid verbal feedback, where such is available, by delaying answering, so as to avoid further failure and lowering of self-evaluation. When problem solution is based on a predetermined number of successful solutions _without_ personal verbalized correction, incorrect choices should reflect upon the personal adequacy of such a subject and so prompt more efficient behavior. Both approaches can be seen as defensive against lowering self-evaluation. Their study was designed to test this suggestion. The results conformed the hypotheses, and the interpretation of defensiveness was reinforced. It was also found that inhibition in the verbal feedback condition is inefficient, since making use of such feedback leads to speedier solutions. As predicted, high failure-avoidant _S_s performed better than low failure-avoidant _S_s when verbal feedback was absent apparently motivated by their internal striving to avoid failure. This may have implications for the current study, wherein non-verbal feedback is given prior to the final task (see method section). Perhaps an exploration of subsequent performance following induced success or failure expectancy would be in order in the light of these findings.

The only question that must be raised is why the "lows" performed more poorly than the "highs" under the nonverbal condition. Given that they were equally intelligent, perhaps equality of performance might have been expected, but how could the removal of verbal feedback, replaced by a red light signalling failure (hypothesized to become aversive) increase the intellectual functioning of one group? The first part of the study - inhibition in the verbal condition - makes sense, but the second part seems to have no logical rationale. (It is hard to see how, except magically, the "aversive" light could potentiate ability so as to make one of two groups equal in ability function at a superior level. The prediction should have been for equality of performance in the non-verbal condition.) In any event, the pertinence of the findings to the current study is evident, and may provide direction for exploration of improvement in performance following feedback.

Mettee (1971) did a study which also bears on defensiveness in the problem-solving situation. He reports a study by Aronson and Carlsmith in 1962 in which it was found that Ss who expected to fail and succeeded unexpectedly subsequently sought to fail. A dissonance interpretation was made: unexpected success would have to be rejected in order for S to hold onto a consistent conception of himself. Mettee offers the alternative that unexpected success must be rejected by a failure-expectant person because accepting the success would lead to an increase in pain as a result of failure when he returned to form. If he saw his chances of reversion to failing as minimal, his acceptance of unexpected success would require him only to resolve the inconsistency. Mettee's study was designed to test these ideas. The results must, again, be taken cautiously, as the author inferred that not giving S information about his performance would preclude subjective failure. This inference is ill-founded; success or failure is not always what E would objectively define it as, but rather may more importantly be based on a subjective interpretation by S (see, e.g., the work of Weiner and Kukla (1970), reported above). In addition, the task used was not really an achievement task, but one purportedly measuring psychological sensitivity. Surely dealing with such an organismic variable is different from dealing with success and failure at an objective, achievement-oriented task. The results showed success expectancy groups to be accepting of their success, while of three failure expectancy groups, only those assured that they would fail in the future (self-irrelevant) accepted success. The author concludes that self-irrelevant success can be accepted while subjects will reject self-relevant success in order to avoid negative consequences other than simple inconsistency. As the likelihood of actually experiencing subjective failure increases, so does the tendency to reject unexpected success. Importantly, subjective failure may be precluded by making the probability of failing nearly certain. (This is consistent with the common achievement motivation finding that $M_{af} > M_s$ Ss choose low $P_s$ tasks.)

Thus, keeping in mind the cautions indicated above, Mettee's study once again points to the defensive strategies employed by failure expectant individuals. It becomes increasingly clear that defensiveness is characteristic of such people in many situations, not limited to the traditional achievement situation. It is, however, the defensiveness in the face of anticipated future failure that is of concern for the present investigation.

Zajonc and Brickman (1969) also did a study based on the rejection of success finding of Aronson and Carlsmith (discussed above). These authors were concerned with the relationship between expectancies, levels of aspiration, feedback and performance. They were aware of the purely subjective nature of success and failure when they pointed out that S defines what is a success (or failure) for him by setting a level of aspiration. Their study explores the effects of expectancies on performance using a reaction time task. First, the effect of expectancy without feedback was explored. Later, feedback was introduced, but kept independent of S's expectancies of performance. The study also sought to explore how changes in expectancies following feedback predict future performance. High and low expectancy groups were established within high and low feedback conditions.

The authors used five trials. No expectancy Ss showed a small, insignificant improvement, while high and low expectancy groups, not differing from each other, showed substantial improvement. Ss who stated high expectancies for block 4 were already performing better during block 3, which was seen as suggesting a possible effect of actual performance or ability on expectancy.

Introducing feedback led to a substantial performance improvement, regardless of whether the feedback was of success or failure. Ss with no expectancies or low expectancies improved more after failure feedback, with only high expectancy Ss improving more after succcss feedback.

Feedback had an effect on expectancies such that subjects raised expectancy after success feedback and lowered expectancy after failure feedback. The high expectancy group, however, stayed higher than the low expectancy group under both conditions.

The effect on performance was quite interesting. Success feedback had no relation to performance. Under failure feedback, those Ss who lowered their expectancies less showed greater improvement in performance.

These results again show failure to be more potent an experience than is success. Further, failure feedback and its effects upon expectancy affect subsequent performance. Thus, failure can serve as an enhancer of future performance. From Zajonc and Brickman's findings, this would seem to occur when S does not redefine success (by drastically altering expectancy) following failure feedback. The effect of failure feedback (i.e., failure expectancy induction) on expectancy and performance in the current investigation might be explored in the light of these findings. (E.g., Feather and Saville, 1967, found failure to produce a decrement in subsequent performance proportional to the amount of failure, while Zajonc and Brickman found failure feedback to enhance performance, depending upon its effect on expectancy.)

Shimkunas (1970) studied the relationship between anxiety and expectancy change as affected by failure and uncertainty. Some basic weaknesses again dictate caution in accepting the results. First, all tasks were tasks of manual dexterity, and no control of individual differences in ability, which could affect expectancies, was made. Second, certainty was defined by 10 trials on the same task while uncertainty was defined by trials on 10 different tasks. However, since all tasks were of manual dexterity, and no measure was taken of whether S saw them as different, "uncertainty" can at best be inferred, and may not really have been a factor in the study.

The central hypothesis was that high anxious Ss would react more to recent experience, and so modify their expectancies, while low anxious Ss would be more stable, adjusting expectancies based upon both recent and remote experience. It was predicted that the high anxious would raise expectancy more under certainty and lower expectancy more under uncertainty relative to the more stable shifts of the non-anxious. Further, these effects would be most prominent when certainty accompanied success and uncertainty accompanied failure, with no difference expected for the non-anxious Ss. The results generally supported the hypotheses, which the author takes as confirmation of his interpretation that the high anxious are more affected by recent experience while the non-anxious have more stable expectancies, modifiable by the combination of recent and remote experience.

Despite the shortcomings of the experimental design mentioned above, the findings of Shimkunas' study suggest that changes in expectancy following success or failure expectancy induction might be explored in the present investigation. Although the certainty-uncertainty dimension, deemed important by Shimkunas, is not present in the current study, such an exploration might still fruitfully be made, since it is unlikely that Shimkunas really had such a dimension in his study either. It seems most likely that what Shimkunas really had was interaction of success/failure feedback with a practice effect rather than with a certainty continuum.

Schwarz (1969) set out to test Rotter's social learning theory as it pertains to the formation of expectancies in a given situation. He first summarized Rotter's theory. Expectancy (E) is defined as the subjectively held probability that a given reinforcing event will occur in a specific situation contingent upon particular behavior. E is determined by two types of experience, $E'$, expectancy built upon previous experience in the same situation and GE, generalized expectancy from similar, functionally related situations. The relative contributions of $E'$ and GE to E are seen as changing with experience. Thus, in a novel situation, E is determined by GE. With experience in the situation, $E'$ develops, and eventually comes to supplant GE as the determiner of E.

Schwarz's study was designed to test the theory, as results had been contradictory. Two measures of GE were taken (including an initial expectancy of success estimate - see method section of this paper), and four personality scales were used. E was measured before each trial by having S estimate his likelihood of success. The task was of motor skill, supposedly related to athletic ability (to which the second measure of GE pertained).

There was a small significant correlation between the two measures of GE, and virtually no correlation between the personality variables and E. The reliability of the E estimates was found to be quite high.

The author saw his findings as demonstrating that GE continues to influence E, and that Rotter's theory is an oversimplification and erroneous. He found the relative effects of GE and É to depend upon attribution, i.e., the more clearly success is seen as a function of skill, the more É comes to influence E.

While the specific findings of the above study may not be directly pertinent to the present investigation, the theory does present a background against which findings with regard to expectancies may be interpreted. More importantly, Schwarz's study has methodological implications for the present study since he used the same general method of measuring initial confidence and success expectancy on each trial (see method section).

c) <u>Attribution</u>:

Attribution theory was dealt with in some detail in the above section on achievement motivation research. Feather's

(1968) suggestion of including a multiplicative perceived locus of control factor in the achievement motivation model and Weiner and Kukla's (1970) attribution theory of achievement motivation have already been discussed. This section will include a brief summary of additional research in the area of success-failure outcome attribution which may be pertinent to the current investigation.

Jones, et al (1968) presented a series of six experiments involving the attribution of ability to self and others, which has theoretical and practical relevance to work in the general field of attribution (e.g., see critique of the experiments of Weiner and Kukla, 1970, above.)

The basic finding is that when judging the performance of others, there is a primary effect, i.e., overall ability is more highly rated in the individual who has early successes in a series of tasks. However, in judging one's own performance, recency is more heavily weighted. It is important, for this effect to manifest itself, that S must perceive the task as one based upon skill (ability), not chance. This finding certainly has implications for the many studies in which the conditions are artificial, where the investigator arbitrarily defines objectively success and failure, and where judgments of the performances of others are taken as equivalent to self-judgments. The findings of this study were carefully considered in the design of the current investigation (see method section).

Feather (1969) studied attribution of responsibility, along with valence of success and failure, in relation to task performance and initial confidence. The portion of the study dealing with attribution will be summarized here. Feather made two predictions: 1) When self-evaluation is positive, success will be attributed to personal factors such as ability, and responsibility for failure will be externalized. When self-evaluation is negative, the opposite pattern of attribution will obtain. 2) When expectation of success is grounded in a stable estimate of ability, and when a person feels he has expended his usual effort, disconfirmation of expectancy is more likely to be externally attributed than is confirmation. Feather summarized his findings: "... Attribution of responsibility following success and failure was not a function of the self-evaluation measures, but it did depend upon a subject's initial confidence, external attribution being more typical when success or failure was unexpected, and when performance was close to the pass/fail criterion. In addition, females were more likely than males to attribute the outcome of external factors ..." (p. 138). In his 1968 paper, Feather strongly emphasizes the importance of a person's perception of his degree of responsibility for the outcome of his performance.

Much of Feather's (1969) method has been adapted for the current investigation, and his findings on attribution have been taken into account in designing the experiment. Since internal attribution is important to the study, it has been built in, using the findings of Feather and others concerning the conditions for facilitating internal attribution.

Fitch (1970) did a study theoretically related to Feather's (1969) reported above. He, too, was concerned with the relationship between self-esteem and attribution. Specifically, he dealt with whether people attribute event outcomes in a way <u>consistent</u> with chronic self-esteem or in a way which <u>enhances</u> chronic self-esteem. The author, as do so many, arbitrarily defined success as achieving a certain score (the 83rd percentile of fictitious norms). Any such figure, as pointed out by Schneider (1969) may be subjectively experienced as failure by at least some college students. The author obtained evidence in support of both the self-esteem enhancement and consistency hypotheses. Low self-esteem <u>S</u>s who "failed" attributed internally, while high self-esteem-failure <u>S</u>s did not. The opposite did not hold.

The author offers the tentative conclusion that high self-esteem <u>S</u>s tend to internalize success but not failure, while low self-esteem Ss tend to internalize both. However, in the light of the work of Jacobson, et al (1970), which indicated the defensive nature of such a variable as high self-satisfaction, might the interpretation of these data not be that the high self-esteem Ss attribute defensively, while the low self-esteem Ss are willing to take responsibility for whatever they do. This is not to deny the possible defensive attribution of the low self-esteem Ss; there are insufficient data to deal with this.

While the design of the present investigation does not call for the inclusion of an attribution measure, and so does not deal directly with the problem of attribution of responsibility for performance outcome, it was felt that it was important to present some of the research relevant to the area of attribution for two reasons: 1) The current study may yield expectancy data which may in turn permit further development of the attribution theory of Weiner and Kukla (1970). Thus, the background material would be important. 2) More importantly, the induction of personal success and failure expectancy is critical to the current investigation, and so the conditions maximizing the likelihood of internal attribution (personal responsibility for success and failure) had to be built into the experimental design. It was thus necessary to include, in order to provide a rationale for the methods used and tests constructed to manipulate success and failure, not only research pertinent to success and failure and expectancies, but also research relevant to the attribution of responsibility for performance outcome.

## Method

Subjects: The subject population consisted of 99 undergraduate psychology students enrolled at Brooklyn College of CUNY and 95 undergraduate psychology students enrolled at York College of CUNY. Of the total N of 194, 34 Ss were excluded from the final sample for the following reasons: Inability to solve Water Jar Problems, N = 29; Copying Anagram solutions, N = 2; Refusal to complete testing, N = 1; Familiarity with the Water Jar Test, N = 2. This resulted in a total usable N of 160, 49 of whom were male and 111 of whom were female.

The subjects were tested in groups consisting of those students who attended class on the day of testing. Three classes (N = 33, 24, 38) were tested at York College, while one class (N = 99) was tested at Brooklyn College. All tests were administered to each group in one session lasting approximately 45 minutes.

One half of each group was given the failure condition while the other half was given the success condition. Having all treatments represented in each class controlled for confounding variables (e.g., time of day, instructor variables, etc.) that might otherwise differentiate the classes.

In order to deal with the findings of Feather (1969) that females have an initially lower confidence level than males and are more prone to externalize responsibility for their performance, a preliminary analysis was performed to compare males and females on initial confidence level and on rigidity scores. No sex differences were found (see Results section), using all subjects (N = 160) and therefore the data for males and females could be taken together in subsequent analyses.

From the population of 160, all Ss scoring 0-1 on the first Water Jar Test (i.e., the number of critical problems solved by the Einstellung method) were classified as non-rigid, while all subjects scoring 3 were classified as rigid. Next, these preliminary groups were subjected to a validation of the success/failure manipulation. The average of the initial confidence estimate and the probability of success estimate for problem 1 of EI was taken as the pre-manipulation base. The average of the probability estimates for the last Anagram problem and problem 1 of EII was taken as the post-manipulation expectancy score. Subtracting the latter of these two measures from the former, (i.e., $\frac{PE_i \div PE\ (EI_1)}{2} - \frac{PEA_{10} \div PE\ (EII_1)}{2}$ ), experimental manipulation was considered to have been successful for Ss whose scores changed in the direction anticipated for their experimental condition. Those whose expectancy scores rose after taking the easy Anagram Test were considered to have been successful manipulated to expect subsequent success. Similarly, those whose expectancy scores decreased after taking the difficult Anagrams Test were considered to have been successfully manipulated to expect subsequent failure. Thus, the final experimental groups consist of all extreme scorers on the rigidity continuum for whom the experimental success/ failure manipulation was effective. From the N of 160, a total of 67 Ss were excluded (see figure 1) due to failure to meet the criteria for inclusion in the experimental groups. This resulted in a final experimental population of 93 Ss, distributed into the four experimental groups as shown in figure 1. As can be seen, the experimental groups were of unequal size.

It should be noted, in this discussion of the experimental manipulation and establishment of the experimental groups that each S had, in the questionnaire completed at the end of the study, the opportunity to indicate any skepticism they may have had concerning the experimental procedure or the fictitious normative data supplied for the Anagrams Test. E's perusal of the questionnaire data showed that none of the Ss responded in such a way as to communicate any such skepticism or disbelief.

Total Students Tested
(after exclusions for failures, cheating, etc.)

| | | |
|---|---|---|
| Male | N= 49 | %= 31 |
| Female | N=111 | %= 69 |
| Total | N=160 | %=100 |

Ss Excluded from Experimental Groups

| | Score of 2 on EI | | No PE change after manip. | | PE opposite to experimental condition | |
|---|---|---|---|---|---|---|
| Male | N= 3 | %= 19 | N= 4 | %= 27 | N= 9 | %= 25 |
| Female | N=13 | %= 81 | N=11 | %= 73 | N=27 | %= 75 |
| Total | N=16 | %=100 | N=15 | %=100 | N=36 | %=100 |

Total Excluded Ss

| | | |
|---|---|---|
| Male | N=16 | %= 24 |
| Female | N=51 | %= 76 |
| Total | N=67 | %=100 |

Composition of Experimental Groups

| | RF | | RS | | NRF | | NRS | |
|---|---|---|---|---|---|---|---|---|
| Male | N=12 | %= 36 | N= 9 | %= 36 | N= 8 | %= 36 | N= 4 | %= 31 |
| Female | N-21 | %= 64 | N=16 | %= 64 | N-14 | %= 64 | N= 9 | %= 69 |
| Total | N=33 | %=100 | N=25 | %=100 | N=22 | %=100 | N=13 | %=100 |

Total Experimental Population

| | | |
|---|---|---|
| Male | N=33 | %= 35 |
| Female | N=60 | %= 65 |
| Total | N=93 | %=100 |

Figure 1: Diagrammatic representation of the establishment of experimental groups and their composition by sex: absolute number and percentage.

<u>Measures</u>: 1. Two forms of the Water Jar Test (EI and EII, see Table 1) were constructed and used in a pilot study. The first had the traditional solution formula B-A-2C, while the second had the solution formula C-B-2A. The two forms were administered to an undergraduate psychology class (N = 22), under Einstellung-inducing conditions, i.e., a time limit of 30 seconds per problem. (This type of administration is used in order to demonstrate most clearly that even under conditions found to maximize the Einstellung-effect, there are still <u>S</u>s who shift to the short method when it is available).

Knight (1963) pointed out that the effort required to solve the first problem was an important factor in subsequent rigid performance. In order to avoid this, the assumption was made that college students would have sufficient arithmetic ability to perform the simple subtractions necessary to solve the problems, and the usual initial "critical-control" problem was omitted; <u>S</u>s were given the example (i.e., taught the Einstellung method) initially. A "Hidden words Einstellung Test", revised from Seltzer (1966) was interpolated between the two Water Jar Tests to separate them in time. The instructions to the <u>S</u>s for the Water Jar Tests were as follows:

You are going to be given some arithmetic prob-

> lems to solve, all of which will be of the same type. Here is an example (Problem A put on blackboard). Here are 3 imaginary jars. The first can hold 13 quarts, the second can hold 29 quarts, and the third, 3 quarts. The jars are empty. Assuming that you have an unlimited water supply, how would you go about measuring out exactly 10 quarts? (The Einstellung method was then demonstrated). You need not make use of all the jars in your solution. You may write your solution in words or arithmetically, as you wish. Each problem is to be numbered and worked on a new page in your booklet. Speed is an important factor, and you will be given only 30 seconds per problem. Do not turn any pages until you are told to do so. You may not go back to any previous problem to change an answer or to fill in one you left out. (The same instructions were used for EII, the only difference being in the specific solution formula taught.)

The Water Jar Test is scored by counting the number of critical problems solved by the Einstellung method, the higher scores indicating more rigidity. Despite the narrow range of scores (0 - 3), these data are traditionally analyzed in the literature by means of parametric techniques. Furthermore, McNemar stated "It is said that distribution-free methods should be used because the assumption of normality, on which parametric tests are based, may not hold. But in light of Norton's study and Bonneau's results, the worry about violating this assumption seems ill-founded..." (1962, p. 374). The two authors cited demonstrated that marked deviation from a normal distribution did not greatly affect the confidence level and significantly increase the chances of making a Type I error.

Table 1. Two forms of the Water Jar Test

| Number | EI (B - A - 2C) Problem A | B | C | Get | EII (C - B - 2A) Problem A | B | C | Get | Type |
|---|---|---|---|---|---|---|---|---|---|
| A | 13 | 29 | 3 | 10 | 10 | 40 | 90 | 30 | Example |
| 1 | 31 | 61 | 4 | 22 | 33 | 27 | 108 | 15 | Set |
| 2 | 10 | 39 | 4 | 21 | 7 | 12 | 36 | 10 | Set |
| 3 | 50 | 102 | 3 | 46 | 113 | 48 | 383 | 109 | Set |
| 4 | 21 | 127 | 3 | 100 | 5 | 3 | 26 | 13 | Set |
| 5 | 14 | 163 | 25 | 99 | 3 | 41 | 54 | 7 | Set |
| 6 | 18 | 43 | 10 | 5 | 29 | 30 | 144 | 56 | Set |
| 7 | 9 | 42 | 6 | 21 | 5 | 9 | 22 | 3 | Set |
| 8 | 23 | 49 | 3 | 20 | 7 | 19 | 45 | 12 | Critical |
| 9 | 11 | 25 | 3 | 8 | 82 | 194 | 470 | 112 | Critical |
| 10 | 10 | 23 | 3 | 7 | 3 | 14 | 31 | 11 | Critical |

The product-moment correlation between the two forms of the test was computed, and turned out to be $\underline{r} = .72$, $\underline{p} < .001$ (2 tailed). To check further on the appropriateness of the utilization of parametric techniques with these data, a rank-order correlation was also computed for the two forms. In this case, rho = .70, $\underline{p} < .001$ (2 tailed). Additionally, rigid and non-rigid groups were established based upon their performance on EI. All subjects who scored 0 - 1 were designated as non-rigid (N = 8) and an equal number of Ss who scored 3 were randomly selected (by lot) and were designated as the rigid group (N = 8). A product-moment correlation between the two forms was then computed using only these extreme scorers (N = 16). This analysis produced an $r = .92$, $p < .001$. It would seem safe to conclude from the above, (as well as from the literature), that such data can be analyzed by parametric techniques and that the two forms of the test may be considered equivalent. The high significant correlation indicates that those who perform either rigidly or non-rigidly on the first form tend to perform in the same way on the second form.

Thus, EI was used as the initial measure on the basis of which rigid and non-rigid groups were established, and EII was used as the second measure of rigidity, the dependent variable upon which the effects of the experimental manipulation were evaluated.

2. The Anagrams Test

The anagrams to be used in this study were taken from the solution time norms provided by Tresselt and Mayzner (1966). It was decided to use solvable anagrams and insure failure by varying the time limit (i.e., by allowing too short a period of time in terms of the solution time norms) so that Ss could, at the end of the test, be given the correct solutions so as to increase credibility. This should protect against Ss feeling that they had been given an impossible task and should thereby enhance the failure experience. Further, it allowed realism when Ss were asked to count their number of correct solutions and enter their (fictitious) percentile rankings.

It was found by Feather (1969) that Ss who passed or failed just near the passing mark were unlikely to consider their score as reflection of their ability, but rather as a reflection of luck. In order to deal with this, the two forms of Anagrams Test (success and failure forms) were constructed so that Ss would succeed very high (99 percentile) and fail very poorly (25 percentile). This also deals with the problem of college student Ss feeling disappointed when they scored "only" in the 90 percentile, which was reported by Schneider (1967). Further, Feather and Saville (1967) found that the amount of prior success and failure had an effect on a) how long the effect would affect subsequent performance and b) how pervasively the success or failure was experienced by S. This provides another reason for making the success and failure scores extreme. Jones et al (1968) found that there was a primacy-recency effect on ability attribution following success and failure. When a subject is predicting the performance of another person, primacy determines the estimates he makes of the ability of the other. When, however, he is predicting his own performance, recency (of success and failure) is the determining factor. In order to control for this variable, the two tests were constructed so as to evince, respectively, early and late success and early and late failure, with both tests having a mixture of success and failure in the middle. The Anagram Test was administered with a 30 second time limit, which was designed to permit the success group to solve at least 7 and the failure group to fail at least 7.

Subjects who do not show the effect of the success/failure manipulation on the validation check were excluded from the experimental groups, but their data were analyzed separately for exploratory purposes.

Table 2 contains the 2 forms of the Anagram Test, including the solution word and the normative median solution time in seconds for each anagram. (See Appendix A for the instructions for the task, and Appendix B for the fictitious norms supplied to the subjects).

3. Estimates of confidence and probability of success

These were adapted from Feather (1969). Following a fictitious introduction to the purpose of the study, including a rationale for the initial confidence measure (See

Appendix A), Ss were asked "What do you feel are your chances of doing well on these tests?" Ss ranked themselves on a 5 inch scale, ranging from 0 - 100% in units of 10, anchored at the extremes with "No chance at all" and "Completely certain", and in the middle with "Even chance." (Instructions for making such ratings are also included in Appendix A.) This measure provides a measure of S's general estimate of his probability of success (success expectancy) which Feather (1969) also concluded was a good measure of S's general self-evaluation.

Table 2. The Anagram Tests

| | Success: Form A | | | Failure: Form B | | |
|---|---|---|---|---|---|---|
| Number | Word | Anagram | Sol.Time in seconds | Word | Anagram | Sol.Time in seconds |
| 1 | judge | egujd | 3.0 | ghoul | hugol | 240.0 |
| 2 | water | aewtr | 3.0 | peony | enopy | 240.0 |
| 3 | voice | eocvi | 4.0 | tango | gaton | 240.0 |
| 4 | bacon | ocbna | 92.5 | funny | nufyn | 5.0 |
| 5 | uncle | eucnl | 72.0 | water | aewtr | 3.0 |
| 6 | flood | olfdo | 5.5 | baton | tanbo | 240.0 |
| 7 | clerk | reckl | 91.5 | train | ntrai | 5.0 |
| 8 | labor | orlab | 5.0 | triad | datir | 240.0 |
| 9 | funny | nufyn | 5.0 | incur | nrcui | 200.0 |
| 10 | train | ntrai | 5.0 | agile | glaei | 240.0 |

Prior to beginning each task, Ss were asked to estimate, prior to seeing the problem, their chances of solving problem 1. They were asked to make similar estimates for each problem of each task following the completion of the previous problem (e.g., after working problem 1, they were asked to estimate their probability of solving problem 2, etc.) These estimates were also made on a 5 inch scale, ranging from 0 - 100% in units of 10. They were anchored at the extremes by "No chance at all" and "Completely certain", and in the middle by "Even chance."

4. Demographic Data and Inquiry

At the completion of the last test, Ss were asked to fill in a brief questionnaire to provide information about their sex, past experience with success and failure in the academic situation, feelings during the testing, about their ability and performance, and birth order.

These latter data were introduced in order to allow analysis of whether any of these variables differentiate between or interact with the groups in any way. The items dealing with feelings and birth order were not analyzed, but were saved for use in future research.

c. Materials: Ss received three test booklets, EI, the Anagrams Test (either the success or failure form), and EII, all of which were mimeographed. Code numbers were placed on all booklets by the experimenter prior to distribution. The Test I booklet contained the scale for the initial probability of success estimate, the EI problems, and the scales for each of the probability estimates to be made during the course of the test. The Test II booklet, prepared in two forms - one for success and other for failure - contained the Anagram problems and the scales for estimating probability of success for each problem. Additionally, this booklet included a separate answer sheet onto which S copied his solution after writing it in the test booklet itself (to avoid changing answers, the test booklets were collected prior to providing Ss with the correct solutions). Finally, attached to this booklet were the solutions for the form of the test taken by S (prepared in such a way that Ss were unable to see them until the appropriate time) and the fictitious norms by means of which S was to evaluate his performance. (See Appendix B.) This procedure was introduced to prevent Ss from seeing that the two forms of the test were obviously quite different in difficulty. The Test III booklet contained the EII problems, the scales for estimating the probability of success of each problem, and the brief demographic questionnaire mentioned above.

d. Procedure: The specific instructions given to Ss can be seen in Appendices A and D.

The subjects were first given a general introduction to the study, and were instructed as to how to make the required probability of success estimates. They were then asked to make their initial, general, probability of success estimate on the face sheet of booklet I. Next, the Ss read the brief introduction to EI, and made their probability estimate for problem 1. The experimenter then demonstrated the Einstellung method (using the same method described above for the pilot study in which equivalent forms were established), and the Ss began the test. Following completion of each problem, the Ss were asked to estimate their chances of solving the next problem prior to seeing it.

Following administration of EI, the booklets were collected, and the Ss were asked to take Booklet II. On the face sheet they read the brief instructions to the Anagrams Test (see Appendix D), in which the nature of an Anagram and of their task was explained to them. As mentioned above, they were asked to record their solutions in two places; in the test booklet and on the separate answer sheet that was provided. The subjects then made their first probability estimate for the Anagrams Test and, again, following completion of each problem, were asked to estimate their chances of solving the next one prior to seeing it. At the completion of the test, the booklets were collected, leaving the Ss with their separate answer sheets. They were then instructed to open their sealed solution sheet (Appendix B), and to count and enter their number of correct solutions and corresponding percentile rank. These sheets were then collected. Ss then were asked to take booklet III, which contained EII, for which the procedure was exactly as it was with EI. The last page of this booklet contained a brief questionnaire which Ss were asked to complete at the end of testing.

The final booklet was then collected, and a debriefing letter (Appendix C) was distributed.

## Results

From the total N of 194, 34 subjects were discarded for such reasons as not taking tests, familiarity with tests, inability to solve Water Jar Problems, and cheating, which resulted in a total usable N of 160, 49 males and 111 females. Table 3 indicates that there are no sex differences, using this population ($p > .50$), in initial confidence or rigidity scores that would preclude mixing the sexes in the experimental groups and subsequent analyses.

Since the established experimental groups (see method section) are of unequal size, all analyses of variance to follow were carried out by means of Winer's (1962) Least Squares Solution.

Hypothesis 1 predicted a) that all rigids would solve more critical problems on EII by the Einstellung method than would non-rigids following the induction of success expectancy, but b) that the rigids and non-rigids would not differ significantly under conditions of induced failure expectancy. The means for the four experimental groups, the results of the analysis of variance, and the results of comparisons made by means of Scheffé's test (McNemar, 1962) can be seen in Tables 4a, 4b, and 4c respectively. (In the tables, NRS represents the non-rigid-success group, RS the rigid-success group, etc.)

It can be seen that there is a significant Rigidity main effect ($p < .001$) indicating that rigids solve more EII problems by the Einstellung method than do non-rigids. There is a trend toward the predicted Rigidity x Condition interaction but it is not statistically significant. The Scheffé analyses yield the following results: 1) There is no significant difference on EII scores between non-rigids as a function of experimental manipulation. 2) Rigids remain more rigid ($p < .05$) than non-rigids following the induction of success expectancy, which indicates that success expectancy does not make the rigid perform less rigidly. 3) Following induced failure expectancy, rigids remain more rigid than non-rigids ($p < .05$). 4) Rigids perform the same ($p > .05$) on EII, regardless of experimental manipulation.

The trend of the interaction suggests an analysis of change scores from EI to EII. Tables 5a, b, and c contain respectively, the mean change scores, the analysis of variance, and the Scheffé comparisons. As can be seen in Table 5b, there is a main Rigidity effect ($p < .001$). Scheffé comparisons were utilized to elicit the meaning of this main effect, and yielded the following results: 1) Neither rigids nor non-rigids change more following the induction of failure expectancy than they do following the induction of success expectancy. 2) There is no significant difference in the amount of overall change between rigids and non-rigids ($p > .05$) when success expectancy is induced. 3) Non-rigids change significantly more following the induction of failure expectancy ($p < .05$) than do rigids, and this change is in the direction of increased rigidity. 4) Non-rigids tend to change significantly more than do rigids under both conditions ($p < .05$).

These results, while disconfirming hypothesis 1b and confirming hypothesis 1a, also suggest that non-rigids are more responsive to experience and their own estimates of their probability of success than are rigids. That is, they are more flexible, changing their problem-solving approach more than do rigids under both conditions. In line with hypothesis 1, this tendency is more pronounced and in the direction of increased rigidity following the induction of failure expectancy.

Further clarification of these results may be obtained from examining the performance of Ss not affected by the experimental manipulation and the analysis of problem-solving approach during problems 1 - 7 of EI and EII.

From Table 6, which shows the EII scores of rigids and non-rigids not affected by experimental manipulations, as well as the results of the t test for the significance of the difference between these means, it can be seen that these two groups differ significantly ($p < .001$) in their EII scores. Thus, rigids and non-rigids both continue to perform as they did on EI. Thus, rigidity - or its lack - of problem solving approach is unaffected when the expectancy factor is absent. These groups contained Ss who took both forms of the Anagrams Test (Rigid, 60% form B, Non-rigid 40% form B). Further, one of the two rigids who scored non-rigid on EII took form B (hard), and solved only 2 problems. These results strongly reinforce the notion that failure expectancy, and not experience per se, is what affects subsequent performance.

In order to clarify further the Einstellung behavior of the experimental groups, exploration was made of their problem-solving approach to problems 1 - 7 of EI and EII. The results of these analyses can be seen in Tables 7a - d.

A non-Einstellung solution attempt is defined as one which uses an approach other than the one taught and which also makes use of the given capacities of the water jars. Thus, e.g., a solution of 27 - 7 = 20 is not a non-Einstellung solution attempt if the problem does not contain a jar of 7 quart capacity. Table 7a shows that non-rigids make significantly more non-Einstellung solution attempts on problem 1 - 7 of EI than do rigids (significant Rigidity main effect, $p < .001$).

Table 7b also shows a significant Rigidity main effect ($\underline{p} < .001$), indicating that non-rigids make more non-Einstellung solution attempts on problems 1 - 7 of EII than do rigids. Thus, the _group_ score for problems 1 - 7 remains the same for both tests regardless of success or failure expectancy induction. However, a change score analysis and/or a correlation between the number of non-Einstellung attempts made on problems 1 - 7 of EI and on EII may show a qualitative difference, i.e., a change in approach.

Table 7c shows the results of the analysis of the change in number of non-Einstellung solution attempts from EI to EII. There are no significant $\underline{F}$ ratios, leading to the conclusion that there are no significant differences between groups on this variable.

Table 7d shows the correlations for the experimental groups between the number of non-Einstellung attempts made on problems 1 - 7 of EI and the number made on problems 1 - 7 of EII. The correlations are significant and approximately equal for the Rigid-Fail group ($\underline{r}$ = .43, $\underline{p} < .01$), the Rigid-Success group ($\underline{r}$ = .46, $\underline{p} < .01$), and for the Non-Rigid-Fail group ($\underline{r}$ = .43, $\underline{p} < .05$). Only for the Non-Rigid-Success group did the two water jar tests fail to correlate ($\underline{r}$ = .14, $\underline{p} > .05$).

The significant correlations for the rigid groups indicate that they adhere to their approach regardless of intervening experience and expectancies. After the induction of success expectancy they seem even more prone to adhere to their rigid approach, as is indicated by the fact that not one non-Einstellung solution attempt was made by the Rigid-Success group on EII 1 - 7.

The Non-Rigid-Success group showed a small, insignificant correlation, indicating no relationship in their approach to the two tests. I.e., they were exploratory, with no set pattern, some shifting from non-Einstellung attempts on EI to Einstellung attempts on EII and vice versa. The Non-Rigid-Fail group, however, showed a significant correlation identical with that shown by the rigid groups. Thus, following the induction of failure expectancy, they performed unlike the Non-Rigid-Success group, but came to perform as did the rigid groups. In view of the previous analyses which showed no change in their number of non-Einstellung attempts, the implication would be that they, in becoming more rigid after coming to expect failure, stuck not to the taught method necessarily, but to whatever approach had proved successful for them on EI. Those who tended to make non-Einstellung attempts on EI 1 - 7 continued to do so on EII 1 - 7, while those who tended to use the Einstellung method on EI 1 - 7 continued to do so on EII 1 - 7. As the

Non-Rigid-Success group altered their approach on EII 1 - 7, while the Non-Rigid-Fail group, like the rigid groups, did not, the interpretation is that the induction of failure expectancy led to more rigid behavior in otherwise Non-Rigid subjects, even though this rigidity was in terms of their own previous approach rather than the taught approach.

Taken together, the foregoing analyses give general conformation to the hypothesis that failure expectancy leads to rigid behavior, which hypothesis 1 was designed to test operationally.

Hypothesis 2 predicted a lower initial expectancy of success (i.e., lower initial confidence prior to beginning the first task) for the rigids than for the non-rigids. The results of the analysis of variance of the initial confidence variable can be seen in Tables 8a - 8c. There is significant Success-Failure main effect ($p < .001$), a significant Rigidity main effect ($p < .05$), and a significant interaction ($p < .01$). Scheffé comparisons show the following: 1) Pooling rigid and non-rigid groups, there is no significant difference ($p > .05$) between rigids and non-rigids in initial confidence, thus disconfirming hypothesis 2. 2) The non-rigid group tends to be approximately equal in initial confidence, i.e., there is no significant difference related to experimental condition. 3) There is, however, a significant difference ($p < .05$) in initial confidence between rigids later susceptible to success manipulation and those susceptible to failure manipulation: those susceptible to failure begin with a significantly higher initial expectancy of success estimate than do those susceptible to success manipulation. (The suggestion is of extreme high or low initial expectancy reports for the rigids, with non-rigids somewhere between and more stable, not varying according to amenability to success or failure manipulation.) The very high initial confidence of the rigid failure group suggests a defensive inflating of estimates by members of this group. 4) The latter comment is supported by the finding that the Rigid-Failure group reports a significantly higher initial confidence level than does the Non-Rigid-Failure group ($p < .05$). 5) There is no significant difference ($p > .05$) between the Rigid-Success and Non-Rigid-Success groups.

In general, then, Rigids later susceptible to failure manipulation report the highest initial confidence of any group, while the Rigid-Success group reports the lowest (although not statistically significant). The criteria for evaluating experimental manipulation might be held accountable, except that the same phenomenon did not occur with the Non-Rigids, whose initial confidence reports were stable across experimental conditions. Thus, the difference must be between Rigids and Non-Rigids, and their different defense structures and modes of reacting to experience, rather than to the manipulation validation criteria. These results are generally supported by an analysis of those Ss not successfully experimentally manipulated. As can be seen in Table 9, a t test shows no significant difference ($p > .10$) in initial confidence reports between Rigids and Non-Rigids when the Success/Failure expectancy dimension is absent. Again, the non-significant tendency is opposite to prediction, i.e., the Rigids tend to give higher initial estimates, which is suggestive, again, of a defensive inflating of confidence reports.

Further clarification of the differential behavior of the experimental groups with regard to success expectancy estimates may be gained from an analysis of the changes in such estimates, both prior to manipulation (Hypothesis 3) and subsequent to manipulation (Hypothesis 4).

Hypothesis 3 predicted that Rigids would show less change from task to task prior to manipulation than would the Non-Rigids. The dependent variable for this analysis (Tables 11a - 11f) is the difference between initial confidence and the average of success probability estimates for problem 1 of EI and the Anagrams Test. Sex differences in confidence in approaching the verbal task could confound the results, and so it will first be necessary to ascertain whether there are such differences.

Table 10 indicates that, for the members of the experimental groups, the sexes are nearly identical in their probability of success estimates preceding the Anagrams Test ($\bar{X}_m$ = 64.42, $\bar{X}_f$ = 64.17, $t$ = .06, $p > .05$). Therefore, the analysis of the data for Hypothesis 3 can be carried out as planned.

The analysis of variance yields a significant interaction ($p < .05$). Rigids who are later susceptible to failure manipulation tend to decrease their expectancy of success on their own, without any manipulation, from task to task. Rigids later susceptible to success manipulation tend to increase their success expectancy prior to manipulation. On the other hand, non-rigids later susceptible to failure manipulation tend to increase their success expectancies prior to manipulation, while those later susceptible to success manipulation decrease their expectancy estimates. Thus, rigids are susceptible to the experimental manipulation which confirms their own "natural" tendency to modify their expectancies while non-rigids are susceptible to the manipulation which contradicts their characteristic expectancy for their own performance. The suggestion is that non-rigids are more responsive to experience while rigids tend to respond to internal sets concerning their expectancy of their performance. There is, further, the suggestion that rigids defensively set their initial confidence levels at high and low extremes, and tend to modify them as they progress from task to task.

Scheffe analysis (Table 11c) indicates that there are no significant differences between rigids and non-rigids in amount of change prior to manipulation, thus disconfirming hypothesis 3. The important finding emerging from this analysis, then, is the real difference between rigids and non-rigids in responsiveness to experience. That is, the non-rigids alter their expectancies in terms of their experiences, and are thus flexible in setting their probability of success estimates. The rigids, on the other hand, seem to have a fixed internal expectancy of performance in terms of which they respond. Although they alter expectancy, it is not in the direction of experience, but rather in the direction of their chronic expectancy of their performance in the situation. The same data were analyzed by chi-square in order to control for Ss whose initial confidence reports were at the extremes and thus did not have room for movement. Table 11d shows that chi-square was significant at the .01 level, and that the differences between observed and expected frequencies were supportive of the findings of the above analysis of variance.

The importance of the subsequent success/failure expectancy dimension can be seen in the analysis of Ss not successfully manipulated experimentally. Table 11e shows that there is no significant difference ($p > .1$) between rigids and non-rigids in proclivity to change probability of success estimates when subsequent manipulation direction is not a factor. These data were also analyzed by chi-square (Table 11f) which supported the above finding of no significant differences for the unsuccessfully manipulated ($p > .30$). These findings differ from those in the study proper which showed differences between rigids and non-rigids related to subsequent direction of manipulation, and show, therefore, the importance of the expectancy dimension for understanding behavior in the problem solving situation.

Hypothesis 4 predicted that both rigids and non-rigids would show a higher estimate of success probability for the average of problems 8, 9, and 10 than for problem 1 on both EI and EII, but that the problem-solving approach leading to this result would differentiate the two types of Ss. The findings reported above, relating to hypothesis 1, support the second part of hypothesis 4, including the suggestion that the problem solving approach of the non-rigid-failure group on EII would be more like that of the rigids than like that of the non-rigid-success group.

Tables 12a - 12f show the results of the analysis of variance for the first half of hypothesis 4, i.e., that the average probability of success estimates for problems 8, 9, and 10 would be greater than that for problem 1 of both EI and EII.

Table 12a shows a significant rigidity main effect ($p < .05$) for EI. Scheffé analysis (Table 12b) shows the following results: 1) Non-rigids decrease their expectancy of success as they progress through EI significantly ($p < .05$) more than do rigids. 2) Rigids later susceptible to success manipulation tend to increase their estimates, while rigids later susceptible to failure hardly change their estimates at all. However, there is no significant difference between rigid groups in success expectancy change during EI. 3) There is, likewise, no significant difference between non-rigid groups in change in success expectancy as they progress through EI; both groups tend to decrease their success expectancy estimates. 4) There is no significant difference between the rigid and non-rigid success groups or the rigid and non-rigid failure groups in expectancy of success change as they progress through EI. The general finding, then, which disconfirms hypothesis 4, is that non-rigids decrease success expectancy as they progress through EI, regardless of which experimental manipulation they will later respond to, while the rigids tend to increase expectancy of success. This does, however, lend some support to the suggested defensive quality of problem solving rigidity. Analysis of the data of those not successfully manipulated can be seen in table 12c. The _t_ test shows no significant difference between rigids and non-rigids ($p > .5$) in the tendency to change success probability estimates as they progress through EI. Again, then, when the dimension of subsequent amenability to experimental manipulation is absent, differences that were found with the experimental groups disappear. The importance of expectancy in determining behavior - performance and confidence reports - in the problem solving situation is again evident.

In Table 12d can be seen the results of the analysis of variance for EII. There is a significant rigidity main effect ($p < .01$) as well as a significant Success/Failure main effect ($p < .001$). In general, the interpretation of defensiveness is supported by these results, as those who have experienced failure expectancy induction tend to increase their probability of success estimates as they progress through EII. This is also done by the rigid-success group, while the non-rigid success group is the only group to _decrease_ success expectancy (as they did on EI). Thus, the central hypothesis of the study (hypothesis 1), that non-rigids led to expect failure will come to behave like rigids, gains support. So, too, does the conception of the defensiveness involved in rigid behavior which allows for the raising of confidence levels with the concomitant avoidance of anticipated failure. Scheffé analysis (Table 12e) shows the following results: 1) Rigids increase expectancies of success during EII significantly ($p < .05$) more than do non-rigids, regardless of experimental condition. 2) However, those, <u>regardless of rigidity</u>, who have experienced the induction of failure expectancy, tend to raise their success expectancy during EII more than do those who have been led to anticipate success. 3) There is no significant difference between the two rigid groups in their tendency to raise success probability estimates as they progress through EII ($p > .05$). 4) Non-rigids led to anticipate failure raise their success expectancies (as do rigids) as they progress through EII, while non-rigids who anticipate success tend to decrease success expectancy during EII, the difference being statistically significant ($p < .05$). This, again, affords some confirmation of the rootedness of rigidity in failure expectancy and of the defensive quality of rigid behavior. 5) These central hypotheses gain further confirmation from the Scheffé analysis showing that there is no significant difference in change in success expectancy during EII between rigids and non-rigids in the failure expectancy condition. Thus, there is a general tendency for failure expectancy induction to result in a raising of subsequent success expectancy reports, which points to the potency of failure expectancy and the ego-defensive nature of the raised expectancy of success estimates.

Table 12f shows that, for those not successfully manipulated experimentally, there is a significant difference ($p < .05$) between rigids and non-rigids: rigids raise their success probability estimates as they progress through EII more than do non-rigids. The implication would seem to be that rigids, leaving out the induced expectancy factor, use their approach to problem solving to raise their confidence, while non-rigids tend to take problems as they come, seeing them as equally challenging. This supports the notion of the defensive nature of rigid behavior.

Why this difference manifested itself on EII and not on EI is unclear. Inspection shows that the PE means for the non-rigids were about the same for EI and EII, while the means for the rigids for the two tests differed widely, in the direction of increased PE during EII. Comparing the rigids on the two tests would yield a $t$ ratio of approximately 15/7, which would be significant ($t = 2.14, p = .02$).

Thus, there is a real difference between the rigids on the two tests, and no such difference for the non-rigids. The simplest explanation then would seem to be that there was some unknown effect of the interpolated task which affected the rigids by creating a high level of anxiety which needed reduction, while there was no such effect on the non-rigids. It might be speculated that this phenomenon might be due to the higher tendency toward test anxiety of the rigids.

In order to clarify the behavior of the experimental groups with regard to their changes in probability of success estimates, an analysis was made of such changes on problems 1 to 7 of both EI and EII (since only the last 3 problems were considered in the preceding analyses). These results can be seen in Tables 13a - 13i.

In Table 13a can be seen the results of the analysis of variance of the average magnitude of change of probability of success estimates, regardless of direction of change, for problems 1 - 7 of EI. There are no statistically significant results, but there is a trend, approaching significance, for those who later succumb to failure manipulation to show larger changes than do those who succumb to success manipulation.

Results of a similar analysis for EII are shown in Table 13b. Again, there are no significant results, and it appears that the groups do not differ in average magnitude of probability of success estimate changes. The trend found in analyzing EI disappears on EII, suggesting that those who expect to fail (through experimental manipulation) become more conservative in making changes in their probability of success estimates. (Inspection of the means for the two tests shows that there is virtually no difference for those who have success expectancy induced.)

To examine further the probability estimate change behavior, as suggested by the trend noted on EI, the number of changes greater than one scale point (a change of 10 or greater) was subjected to an analysis of variance for both EI and EII (see Tables 13c and 13d, respectively).

On EI, there is a significant success-failure main effect ($p < .05$). Thus, regardless of rigidity, those who later are successfully manipulated to anticipate failure make more large changes in their expectancy of success than those amenable to success manipulation. The rigids make the most (fail group) and fewest (success group) large changes, with the non-rigid groups between these extremes, but the trends are not statistically significant. For EII (Table 13d), the analysis of variance yields, likewise, no significant results. However, there is a strong trend toward an interaction ($p$ between .1 and .05) such that the non-rigid-fail group makes fewer large probability estimate changes on EII than does any other group. The general success/failure trend found for EI disappears on EII. Thus, following experimental manipulation, the non-rigid-fail group seems to become more conservative in making probability estimate changes, while the other groups perform much as they did on EI. The induction of failure expectancy, then, appears to have caused the non-rigids to behave on EII as the rigid-success group did on EI (and EII), suggesting some support for the central hypothesis, i.e., that rigid behavior is rooted in failure expectancy.

One further exploratory analysis was made concerning changes in probability estimates. The results of an analysis of the total number of such changes made during problems 1 - 7 of the two tests can be seen in Tables 13e and 13f respectively. There are no significant results for EI or for EII, leading to the conclusion that the groups do not differ in the total number of probability of success estimate changes made during the two tests. However, inspection shows that the non-rigid-fail group made the most changes on EI and the fewest on EII (not significant). This is consistent with the above finding of their becoming more conservative in making changes following manipulation, and suggests an exploration of <u>change scores</u> (from EI to EII) on the variables concerning probability of success estimates during problems 1 - 7 that were done above for the two tests separately.

The results of the analysis of variance of the average magnitude of change of probability of success estimates from EI to EII appear in Table 13g. There are no results significant at the .05 level. A success-failure effect with p between .05 and .1 suggests a trend similar to the earlier one, that those who have come to anticipate failure become more conservative in making changes in their estimates of their probability of success (i.e., they make smaller changes). This trend, again, is most pronounced in the non-rigid-fail group.

Table 13h shows the results of the analysis of the changes from EI to EII (problem 1 - 7) to make large changes in probability of success estimates (i.e., changes greater than one scale point). There is again a tendency towards a success-failure effect with p between .05 and .1. Following failure expectancy induction, there is a tendency to make fewer large changes in probability of success estimates. This tends to support the above findings as does the fact that once again the effect is most pronounced in the non-rigid-fail group.

The results of analyzing the change from EI to EII in the total number of probability estimate changes made during problems 1 - 7 appear in Table 13i. These results tend again to support the above findings: there is a success-failure effect (*p* between .05 and .1) showing a trend toward greater conservatism following the induction of failure expectancy. That is, those so manipulated tend to make fewer probability estimate changes on EII than they did on EI. Again, too, this effect is most pronounced in the non-rigid-fail group.

To summarize the results of the above exploratory analyses: there appears to be an initial difference in propensity to make probability of success estimate changes between those amenable to success manipulation and those amenable to failure manipulation. The manipulation, however, blots out these differences as those who come to anticipate failure become more conservative in changing their subsequent estimates of their probability of succeeding. This is true across the rigidity dimension, although it is most pronounced in non-rigids who "fail" and who are led to anticipate subsequent failure.

Prior Experience with success and failure

In order to more fully understand the behavior of the experimental groups in reaction to induced success or failure expectancy, an exploratory analysis of prior (reported) experience with success and failure was carried out.

Table 14a shows the results of the analysis of variance of reported High School Average. There is a significant rigidity main effect ($p < .01$) indicating that rigids report higher High School Averages than do non-rigids. There are two alternative explanations of this finding. First, rigidity in problem-solving may be more efficient in our current educational system. The alternative explanation of defensively high reporting (these data were collected after testing) by the rigids cannot be ruled out without further research to determine whether the difference is in reporting or in actual achievement.

The results of the analysis of the number of college courses failed appear in Table 14b. There is a significant ($p < .05$) rigidity main effect, such that non-rigids report failing more college courses than do rigids. The two alternatives introduced above are also applicable to this finding. Further, it is possible that the non-rigid is more tenacious in the face of failure and so is willing to try college after having done poorly in High School, where the rigid would not. Thus, more failures would be expected. (The above results concerning Einstellung behavior, see Tables 7a - 7d, support this hypothesis. To further investigate it, an analysis of solutions during problems 1 - 7 of the two Water

Jar Tests will be carried out below.)

Table 14c shows the results of the analysis of variance of reported college average. There is a significant success-failure main effect ($p < .05$). Those who have experienced failure expectancy induction report a lower college average than do those led to anticipate success. Again, the above proposed alternative explanations can be considered. Another possibility is that, given that the reports were given following testing and prior to debriefing, this finding may be a result of the potency of the failure experience.

The highest average is reported by the Rigid-Success group, which may be reflective of the previously found tendency of the rigid to move his confidence reports in the direction of confirmation of his characteristic expectancy. It may also reflect defensive inflating of reports. The lowest average is reported by the Non-Rigid-Fail group, which may be reflective of responsiveness to the situation or one of the above alternatives. However, all attempts at explanation must be considered tentative and speculative pending further research into whether the differences are real or reported (and hence reactive to the experiment). Of course, too, lower averages for the non-rigids are to be expected if they, as reported, failed more courses than the rigids.

Problems solved during the study

In order to examine further the differences in achievement between the experimental groups, an exploratory analysis of actual solutions during problems 1 - 7 of the two Water Jar Tests was carried out.

The analysis of variance of the number of correct solutions on problems 1 - 7 of EI (Table 15a) shows a significant rigidity main effect ($p < .05$). The rigids solve more problems than do the non-rigids. The implication, taking into account all of the foregoing analyses, seems to be that rigids are more concerned with getting correct answers while non-rigids are concerned with finding new ways of doing things, even to the point of tolerating objective failure in order to do so. (Rigidity, then, may be more efficient in current academia, but apparently at the expense of creativity.) This may explain the non-rigid's previously noted tendency to reduce expectancy of success estimates, and may also indicate that non-rigids define failure differently than do rigids and are able to tolerate objective failure, i.e., not getting the right answer.

Table 16a shows the results of the analysis of variance of the number of solutions on problems 1 - 7 of EII, i.e., following experimental manipulation. There is a significant rigidity main effect ($p < .001$) and a strong trend ($p < .10$)

toward a success-failure effect. Rigids, again, solve more problems correctly than do non-rigids. (This does suggest that the observed differences in High School Averages, etc., may really be differences in achievement rather than differences in reporting, although this must still be verified through additional research.) The success-failure trend is based on non-rigids solving more problems following the failure manipulation than following success manipulation. Thus, with the induction of failure expectancy, non-rigids again came to behave as did rigids, lending further support to the causal relationship that is the central hypothesis of this study.

The analysis of variance of the change in number of correct solutions of problems 1 - 7 from EI to EII can be seen in Table 17a. This analysis yields no significant results, and all groups can be seen to have solved more problems correctly on EII than on EI. The trend is for rigids to increase the number of solutions under both experimental conditions, for the non-rigids to show virtually no change following success manipulation while showing a greater increase following failure manipulation. (Rigids also increase the number of correct solutions more after failure than after success.) Again, the trend is as predicted, with the previously established non-rigids coming to behave as did the rigids, after failure expectancy is induced.

A most important aspect of these results is the effect of failure as an <u>enhancer</u> of subsequent performance, when previous research often shows failure to produce a decrement in subsequent performance. The difference appears to be in the current investigation's concern with the problem-solving approach (Rigidity) dimension, as well as with the expectancy dimension, and lends credence to the theory of rigidity as a defensive approach to problems, geared toward the avoidance of anticipated failure.

To pin down the effects of the manipulation on the performance of problems 1 - 7 on EII, and, in turn, on problems 8 - 10, a correlational analysis (Table 18a) was performed, relating the number of correct solutions on problems 1 - 7 of the two Water Jar Tests. There were significant correlations for the Rigid-Fail group ($r$ = .51, $p<.01$), the Rigid-Success group ($r$ = .43, $p<.02$) and the Non-Rigid-Success group ($r$ = .76, $p<.01$). The only group that did not show a significant correlation was the Non-Rigid-Fail group ($r$ = .20, $p>.1$).

$T$ tests for the significance of difference between correlations (Table 18b) show no significant differences in the correlation of EI and EII (1 - 7) between the rigid groups, while there is a significant difference between the non-rigid groups ($p < .05$). There are also significant differences ($p < .02$) between the Rigid-Success and Non-Rigid-Success group and the Rigid-Fail and Non-Rigid-Fail groups.

Thus, the two forms of the test remain significantly related, during problems 1 - 7, for the rigid groups and for the non-rigid-success group, while the tests lose their relationship for non-rigids following the induction of failure expectancy. These analyses would seem to indicate that the two tests are seen and approached in the same way by the two rigid groups, regardless of interpolated expectancy, as they continue to seek correct solutions. The two tests seem to be seen in the same way by the non-rigid-success group, who apparently continue to be exploratory rather than seeking right answers. (This is consistent with the results discussed above; see Table 7d relative to hypothesis 1.) With anticipated failure, however, the non-rigids alter their approach, making them the only group for which EI 1 - 7 and EII 1 - 7 do not correlate. It would seem, then, that at least some members of the non-rigid-fail group came to seek correct solutions on EII (confirmed by the above finding that this group solves more of problems 1 - 7 on EII than does the non-rigid-success group), instead of seeking alternatives as they had done on EI, and hence came to behave, following the induction of failure expectancy, more like the rigid groups.

Ss responding opposite to manipulation

Finally, a qualitative analysis was made of the performance of Ss who responded to experimental manipulation in the opposite direction to that planned. Of the 36 Ss who did this, 29 (81%) were rigid while only 7 (19%) were non-rigid. 12 of these Ss (33%) manifested success expectancy following administration of the difficult Anagrams Test while 24 (67%) showed failure expectancy after taking the easy form.

The mean number of anagrams solved (Table 19) was about the same for all groups. Since one form of the Anagrams Test was very difficult and the other very easy, Ss solving equal numbers of problems on the two forms suggests differential ability to handle the material. That is, those who were able to solve 5 - 6 of the hard anagrams must be seen as superior at the task (or perhaps even at general verbal ability) than are those able to solve only 5 of the easy items.

In the experimental groups, wherein all Ss were successfully manipulated, this situation did not obtain, as the success and failure groups solved different numbers of anagrams. Thus, only 9 of 55 failure Ss solved as many as 5 anagrams, while the means for all of the reversal groups was higher than 5. Similarly, only one success S solved as few as 5 anagrams, most solving in the 8 - 10 range.

Comparing Tables 8a (mean $PE_i$ for experimental groups) and 20 (Mean $PE_i$ for the "reversers"), the same general pattern of $PE_i$ can be seen. For the experimental groups, (Table 8a) the Rigid-Fail group had the highest $PE_i$, the RS group the lowest, and the two non-rigid groups were intermediate. For the reversers, the rigids who came to expect failure (i.e., RF) had the highest $PE_i$, the rigids who came to expect success (i.e, RS) had the lowest $PE_i$, and the non-rigids were again intermediate.

Inspection of the two tables, however, shows large differences in the absolute values of the mean $PE_i$'s of the experimental and reversal groups. This difference suggests[2] that perhaps there was a bias involved in the exclusion of Ss from the experimental groups, in that subjects may have systematically selected themselves out of the experiment. The above suggested difference in ability with regard to the Anagram task is one possible source of bias. In addition, as the reversal group contained a large proportion of females (see Table 22), sex differences in EI scores and $PE_i$ might be found in the experimental population (N=93).

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[2]Gratitude is expressed to Dr. Jesse Smith for suggesting this line of analysis.

Table 23 indicates that there are no sex differences in rigidity in the experimental population. However, the female Ss in the experimental groups are found to have a significantly ($p < .05$) lower $PE_i$ (63.7) than the males in these groups (71.5).

Table 22 shows, on the other hand, that for the reversal Ss, the females had a much higher mean $PE_i$. The difference of 6.2 points failed to reach statistical significance because of the small N in the male group, which also showed much variability, leading to a high error term in the significance test.

Table 24 indicates that when the experimental Ss are combined with the reversal Ss, the sex differences in $PE_i$ are obliterated. It would thus seem safe to conclude that the experimental procedure allowed for the systematic exclusion of female Ss of high $PE_i$; and that this exclusion accounts for the significant sex differences shown in Table 23.

Thus, the results of this study appear to have been confounded by subtle and unexpected sex differences. This might suggest combining the reversers with the group indicated by their post-manipulation expectancies and re-analyzing the date. However, this would introduce another, possibly more serious, confounding variable, that of verbal ability, or at least the ability to solve anagrams. The bulk of the reversers (24 of 36) experienced failure after the easy anagrams task, and a large proportion of the female reversers (18 of 27) were in this group. As alluded to above, those able to solve 6 of the hard anagrams obviously differ in ability from those above to solve only 5 of the easy anagrams. The suggestion is, then, that those - particularly females - of lower anagram ability and higher $PE_i$ (perhaps defensively inflated) were excluded from the experiment and cannot, because of the possible confounding, simply be reinserted. Rather, the study would have to be done over, controlling for sex differences and verbal ability, before any definitive conclusion could be drawn. The results of the present study, then, must be taken as suggestive at best. This is true even though an equal percentage of males and females were in each experimental group. The systematic exclusion of high $PE_i$-low ability females resulted in sex differences in the experimental population despite what would have appeared to be a control of sex differences through uniform proportional representation of the sexes in the groups. This percentage equality of the sexes in the experimental population appears to be an artifact.

## Discussion

General Discussion of Hypotheses: Only one of the formal hypotheses was confirmed. This may partially be due to the sex differences found in the experimental groups which may have resulted in a biased exclusion of female subjects. The fact that only one hypothesis was confirmed may also partially be due to the theory which generated the predictions having been an oversimplified one. In formulating the hypotheses, direct translation to problem-solving behavior was made from observations of rigid subjects, with no account being taken of the possible interaction of rigidity with achievement motivation and defensive attribution (which, through post hoc analyses, suggest themselves as important factors). In addition, insufficient emphasis was placed upon expectancy as a causal factor in achievement related behavior. Also, expectancy was dealt with more as an effect (e.g., predictions of defensive shifts in expectancy) than as a cause, other than with regard to evoking rigid behavior. Subsequent exploratory analyses which were purely post hoc, suggested instead that expectancy was a cognitive mediator of several achievement related behaviors.

It cannot be overemphasized that the formally stated hypotheses were, with one exception, disconfirmed. Any results emerging from this study must be considered as suggestive at best. Although the post hoc analyses produced some consistently significant results and consistent trends, which were not at variance with the original thesis, the posture is not being taken that these findings provide direct evidence supporting the theory. Rather, they are seen as doing little more than suggesting avenues of investigation for future research.

With the aid of hindsight, it might be possible to reformulate the hypotheses in such a way as to enhance the possibility of their confirmation.

Hypotheses 1 might be left as stated, since a trend in the predicted direction was found. The failure to reach significance might have been a function of the bias in subjects' self selection and consequent sex differences. However, Hypothesis 1 might be restated in correlational terms: There will be a significant correlation between the approach taken during problems 1 - 7 of EI and EII, as reflected in the number of non-Einstellung solution attempts made, for both Rigid groups and for the NRF group, while there will be no such correlation between the number of non-Einstellung solution attempts made during the two tests for the NRS group. The rationale for this hypothesis would be that success expectancy does not foster exploration in the rigid, while failure expectancy does inhibit exploration in the non-rigid.

Hypothesis 2 might be stated in terms of achievement motivation theory, since a relationship between rigidity and Maf has been established (Howard and Slatus, 1966). Rather than postulating uniformly lower $PE_i$ for the rigid Ss, the hypothesis might be stated: Initial confidence levels of the rigids will be at the extremes of perceived task difficulty, (high and low $PE_i$) while the non-rigid groups will set their $PE_i$'s intermediate to these extremes.

Hypothesis 3 could be restated in terms of expectancy theory: In progressing from task to task, rigid Ss will tend to alter their probability of success estimates in the direction of their chronic expectancies concerning their performance in the achievement situation. The non-rigid Ss, on the other hand, will tend to alter expectancies of success according to experience in the situation.

Hypothesis 4 could be restated as follows: 4a) Prior to experimental manipulation (EI), while progressing through a task, the rigid Ss will raise their probability of success estimates as measured by $PE(EI_1) - \frac{PE\ (EI_{8,9,10})}{3}$. The non-rigids will alter their estimates in accord with their experience during the test. 4b). Following manipulation, the RF and RS groups will continue to function as they did on EI, and the NRF group will come to raise PE as do the rigid groups. The NRS group will continue to alter PE in accord with experience.

Keeping in mind that the hypotheses of this study were not confirmed, and that what follows is suggestive of areas of future investigation (although the consistency of the patterns which emerged is striking), the discussion now turns to the findings of the study and some of its suggested theoretical implications.

Hypothesis 1a was confirmed, in that rigid subjects solved more critical problems on EII by the Einstellung method than did non-rigid subjects under both experimental conditions. Hypothesis 1b was not confirmed, although there was a statistically insignificant trend toward the predicted rigidity x condition interaction.

A change score analysis bearing on hypothesis 1, however, showed that the non-rigids (N - R) change more following the induction of failure expectancy than do the rigids (R), and that this change was in the predicted direction of increased rigidity. The R groups showed no change, the N - R groups changing more than they did under both conditions (with the difference being significant only after failure expectancy induction).

These results suggest that the R respond less to expectancy change by altering their problem-solving approach than do the N - R. The implication is that the N - R respond in terms of experience, while the R tends to respond more in terms of internal sets. The importance of the expectancy factor is shown in the analysis of the Ss who were not successfully experimentally manipulated: When the expectancy factor is neutralized, both R and N - R continue to function on EII as they did on EI. This latter result would seem to support the contention that expectancy, and not experience per se, affects subsequent performance. Experience appears to play a role only to the degree that it contributes to an alteration of success expectancy.

Further analysis showed the N - R to be more exploratory prior to the critical problems than are the R, both on EI and EII. Correlations between the number of non-Einstellung solution attempts on EI and EII were significant and of the same order for all but the non-rigid-success (NRS) group. This group, then, remained exploratory, showing no relationship in their approach to the two tests. The non-rigid-failure (NRF) group behave unlike the NRS group, but more like the members of the two rigid groups. That is, they adhered to the method they had used on EI. Importantly, however, they adhered not to the taught method, but to whatever approach they had taken on EI. Thus, although they increased in rigidity as a function of induced failure expectancy, they still were differentiated from the rigid Ss in their adherence to their own approach rather than to the taught approach.

The conclusion is, then, that the induction of failure expectancy led to rigid behavior in otherwise non-rigid Ss. Although the NRF group adhered to their own approach, this adherence, which differentiated them from the NRS group and made them more like the rigid-success (RS) and rigid-failure (RF) groups, defines an increase in rigid behavior.

Although the specific hypothesis 1b was disconfirmed, then, its theoretical rationale and implications received general support from the results of the unplanned analyses which pertained to it.

Hypothesis 2 was disconfirmed as no differences were found in initial probability estimates ($PE_i$) between pooled rigid and pooled non-rigid subjects. The two non-rigid groups were found to be approximately equal in $PE_i$, while the RF group had a significantly higher $PE_i$ than did the RS group. When the expectancy factor was absent (unsuccessfully manipulated Ss), there was no difference found between rigids and non-rigids on $PE_i$.

The ordering of these initial confidence estimates is of interest. RF was highest, RS was lowest, while the two non-rigid groups were equal and between the RS and RF groups. If the $PE_i$'s of the RS and RF groups can be considered to define the range of perceived difficulty of the achievement situation as presented, and the scores of the NRS and NRF groups to be intermediate within that range, the familiar U - curve of the achievement motivation literature emerges. Thus, the rigid groups define the situation at the extremes of difficulty, while the non-rigid groups define the situation as being of intermediate difficulty. This would suggest that the rigid groups represent individuals high in $M_{af}$ while the non-rigid groups represent people low in $M_{af}$. This is consistent with the rationale for this study which pictured the rigid individual as failure-avoidant. It also follows from the finding reported by Howard and Slatus (1966) to the effect that rigids have higher TAQ scores than do non-rigids, and is consistent with Weiner's (1970) finding concerning the power of the TAQ in setting up motive groups in achievement motivation research.

The defensive quality theoretically attributed to rigidity also gets some support from the above results, at least for the RF group. Jacobson, et al (1970) found that need for approval and social desirability "... represent defensive behavior resulting from an intense concern with avoiding failure ..." (p. 55). These measures were related to the reporting of high expectancies of success. This would suggest that the $PE_i$ scores of the RF group, then, might have been defensively high.

The apparent relationship between the current experimental groups and the motive groups characteristically used in achievement motivation research may enhance the application of some of the results of this study to achievement motivation theory.

Although hypothesis 2 was disconfirmed (in fact, largely contradicted), some important implications emerged from the results of the analyses of the data pertaining to it.

Hypothesis 3 was also disconformed with both rigid and non-rigid groups changing PE from task to task prior to experimental manipulation. Specifically, RF subjects tend to decrease PE, RS subjects tend to increase PE, NRF subjects tend to increase PE, and NRS subjects tend to decrease PE. All of these changes are made by the Ss on their own from task to task prior to any manipulation.

Schwarz (1969) briefly summarized Rotter's social learning theory as it applies to the formation of expectancies. Expectancy is defined by two types of experience, É, expectancy built upon experience in the same situation and GE, generalized expectancy from similar, functionally related situations. In a novel situation, E is determined by GE, which is eventually supplanted as the determinant of E by É as a function of experience in the situation. Schwarz's study led to the conclusion that Rotter's theory was oversimplified and erroneous, and that the influence of GE could persist.

The results of the analysis of the data for hypothesis 3 suggest that rigid *S*s are susceptible to the manipulation which *confirms* their GE, while non-rigid *S*s are susceptible to the manipulation which disconfirms their GE. That is, the non-rigid *S*s are more responsive to experience, willing to alter direction of their expectancies; they develop É which comes to supplant GE in determining subsequent expectancy. The rigid subjects, however, do not respond to experience (develop É), but rather respond to that which confirms their internal sets (GE), which may, again, be a defensive strategy. These results support Schwarz's contention that E does not necessarily become determined by É, which in turn depends upon the organism's reinforcement schedule in the situation. As will be discussed below, rigids had more correct solutions (reinforcements) than non-rigids, and still continued to primarily be influenced by GE.

The key finding for present purpose is that non-rigids appear to respond to experience while rigids appear to respond more in terms of internal sets concerning their performance. Given the findings discussed above, these internal sets are likely to be defensive strategies geared toward the avoidance of the pain of anticipated failure.

Support for the defensiveness hypothesis comes from the attribution theory of achievement motivation posited by Weiner and Kukla (1970). Altering expectancy in the existing direction serves to define the task as easier (for RS) or more difficult (for RF). This allows outcome to be externalized, i.e., to be seen as a function of tasks difficulty rather than of ability. The non-rigid alters expectancy in the direction of experience, which suggests a willingness to take responsibility for performance outcome. It must be remembered that the RF and RS groups are comprised only of Ss who subjectively experienced, respectively, failure and success, and attribution-as-defense theory would appear to account adequately for their behavior with regard to expectancy change. Further support for a defensive interpretation comes from the work of Mettee (1971) who, studying rejection of unexpected success, found subjects to defensively need to both enhance and to perform consistently with their usual conception of themselves.

With regard to hypothesis 4, there have already been discussed several findings consistent with a defensive interpretation of rigidity. The analyses relating to hypothesis 1 which show a) a difference in problem-solving approach to differentiate the rigids from the non-rigids on EII and b) the NRF group to come to behave more rigidly on EII (albeit in terms of their own approach rather than the taught approach) support those aspects of hypothesis 4b which pertain to similar phenomena. In general, however, hypothesis 4 is not confirmed, although there are some meaningful findings which contribute to the theory being tested.

The specific findings for EI were as follows: 1) NR, pooled and separate, decrease PE as they progress through EI, disconfirming hypothesis 4b. 2) RS increase PE as predicted, while RF does not change. The difference between the rigid groups is not significant, and hypothesis 4a is not confirmed. 3) There are no differences between RS and NRS or RF and NRF in the tendency to alter PE as they progress through EI.

For EI, then, the conclusion is that non-rigid groups tend to decrease PE. This reflects their responsiveness to experience, as they in fact solve fewer problems than do the rigids, being more concerned with exploring alternative solution methods than with getting objectively correct answers. They also, based upon expectancies, appear willing to take responsibility for the objective outcome. The rigids, on the other hand, tend to increase as predicted, but not significantly so. The fact that they seem to concentrate on getting correct answers and tend to increase PE offers some support for the hypothesized defensive nature of rigid problem-solving behavior.

The defensive nature of rigidity and the rigidifying effect of induced failure expectancy are seen much more clearly in the alterations of PE that occur as Ss progress through EII.

Those who experience failure expectancy induction increase PE as they progress through EII. This is done also by the RS group. The NRS group is the only group not to raise PE as the Ss progress through EII. Again, the NRF come to perform as do the rigids, and unlike their NRS counterparts. This suggests further support for the contention that failure expectancy in the achievement situation - chronic for the rigids, induced for the NRF - leads to rigidity in problem solving and that such rigidity is a defensive strategy geared toward the avoidance of anticipated failure. The results for EII, then, provides partial confirmation of hypothesis 4.

These findings gain further clarity when specific comparisons are considered. 1) When R and NR Ss are compared, the R are found to increase PE significantly more as they progress through EII than do the NR. 2) Regardless of rigidity, those who have failure expectancy induced raise PE significantly more than do those who undergo success expectancy induction. 3) There is no significant difference between RS and RF groups, which lends support to the suggestion of the rigid as being an individual with chronic failure expectancy in the problem-solving situation. 4) NRF raise their PE, while NRS lower their PE, the difference reaching statistical significance. 5) The RF and NRF groups do not differ in PE increase.

Taken together, these findings support a theory of causal relationship between failure expectancy and rigidity. Such failure expectancy is relatively stable in the chronically rigid. Rigidity, however, can be situationally determined, when failure expectancy is induced. The general tendency of failure expectancy to result in the raising of PE reports points to the potency of failure expectancy and the ego-defensive nature of the raised PE estimates. This goes along with the findings discussed above which show the NRF to come to function more like the rigids and less like the NRS following the induction of failure expectancy.

Further support is gained from the analysis of the unsuccessfully manipulated Ss, where the rigids are found to raise PE significantly more than do the non-rigids as they progress through EII.

The rigid individual, then, appears to use his approach in order to raise his confidence, while the non-rigid appears to take problems as they come, seeing them as equally (veridically) challenging.

Again, the concept of the rigid person as a failure expectant person is suggested, and is of theoretical importance. Raising PE implies perception of the task at hand as easier. This allows success to be externally attributed. It has already been shown (see above discussion) that failure-expectant people externally attribute success (Mettee, 1971, etc.). The non-rigid (except when led to anticipate future failure) apparently sees each of these tasks as equally difficult, which allows for internalized attribution of performance outcome. Apparently such individuals have a generally positive expectancy with regard to their ability, which can be modified by experience in a given situation. This modification is temporary, and each new task is taken on its own, with a willingness to tolerate the chance of failure. By keeping their PE relatively constant, i.e., by perceiving the problems as equally difficult and therefore seeing outcome as a function of ability, these Ss appear to be communicating their desire to face challenge, i.e., to pit their ability against presented problems. Restating simply, they seem to enjoy the challenge of problem-solving, and are willing to tolerate failure. This latter point can easily be seen in their approach to the Water Jar Tests wherein they solved few problems, concentrating instead on finding creative solution methods. The picture changes, as has been seen, when failure expectancy has been successfully induced, and the otherwise non-rigid individual comes to behave, in virtually all aspects of the situation, as does a rigid person.

Thus, expectancy can be seen to be an important cognitive mediator of outcome attribution, which, in turn, can be viewed as defensive strategy. This has implications for achievement motivation theory (Weiner and Kukla, 1970) and will be discussed below.

II Exploratory Analyses

The above analyses dealt primarily with problems 8 - 10, the critical problems, on the Water Jar Tests. It seemed reasonable that important experiences on problem 1 - 7 might have contributed to the results and/or that further clarification of the results might be obtained through an examination of performance on problems 1 - 7.

Changes in probability of success estimates during problems 1 - 7 of both EI and EII were studied.

On EI, those later subjected to failure expectancy induction make more large PE changes than do those later manipulated to expect success. The ordering again shows the rigids at the extremes - RS fewest large changes, RF most large changes - with the non-rigid groups between. These trends, however, are not significant.

On EII there is a non-significant trend for the NRF group to make fewer large PE changes than does any other group. Thus, there is a tendency, albeit statistically not significant, following the induction of failure expectancy for this group to become more conservative in making PE changes while the other groups behave as they did on EI. They come, then, to behave like the RS group on EII, rather than like the NRS group as they had on EI.

Analysis of the number of PE changes made also yielded a non-significant trend toward more conservative behavior on the part of the NRF group. They made the most changes on EI and the fewest changes on EII (not significant).

Analysis of changes from EI to EII in absolute magnitude of PE changes showed an insignificant trend (p between .05 and .1) toward a success-failure effect. The trend was for those anticipating failure to make smaller changes on EII than they had on EI, the trend being most pronounced for the NRF group.

A similar analysis was done for the number of large PE changes made, with similar results. Again there was a non-significant trend (p between .05 and .1) for those in the failure expectancy groups to become more conservative, i.e., to make fewer large PE changes on EII. The trend, again, was most evident in the NRF group.

The same non-significant trend (p between .05 and .1) was found in analyzing the change in total number of PE changes from EI to EII. Again, the trend, most pronounced in the NRF group, is for more conservative PE changes following the induction of failure expectancy.

Thus, following the development of failure expectancy there is a suggestive trend toward increased conservatism in making subsequent PE changes. Those anticipating failure may become less reactive to experience and more reactive to the internalitze set - failure expectancy - which has been induced. Thus the NRF group comes to behave more like the rigid groups and less like the NRS group. In this way, they may defensively be able to attribute the anticipated failure to task difficulty rather than to their own ability. Examination of table 21 supports this interpretation. Those who expect to fail start EII with a much lower PE than do those who expected to succeed, communicating an expectancy of high task difficulty. By making fewer changes and smaller changes in PE during the test they show a) the persistent influence of failure expectancy and b) an attempt to keep perceived task difficulty high so as to allow for external attribution of the anticipated failure. This interpretation gains support from the data presented above which showed the

TABLE 21

Mean PE for problem 1 of EII for the experimental groups.

| Group | Rigid | Non-Rigid |
|---|---|---|
| Failure | 47 | 45 |
| Success | 80 | 77 |

NRF group to be within the intermediate range of perceived difficulty and equal to the NRS group on $PE_i$. The interpretation must be considered speculative, however, given the lack of statistical significance and the absence of an attribution measure. Inclusion of such a measure might be included in future research to test this and other interpretations made in terms of attribution theory.

It should be noted that the above discussed trend is consistent with Feather and Saville's (1967) finding concerning the relative potencies of failure and success. Failure expectancy seems to have a profound effect on subsequent expectancies, while success expectancy seems to have little, if any, effect. Failure expectancy appears to have a generally constricting effect on subsequent behavior.

The possibility that past experience with success and failure might have influenced the results of this study was considered through the analysis of reported High School Average, College Average, and College Courses Failed.

The rigid Ss reported significantly higher High School Averages than did the non-rigids. Further, the non-rigids report failing significantly more College Courses than do the rigids.

Two possible explanations suggest themselves for these findings: a) There may be defensively high reporting by the rigids and b) The rigids may actually achieve at a higher level, suggesting that a rigid approach to problem-solving is more efficient in current academia.

Neither alternative can be accepted without further research, which includes actual scholastic achievement data, to determine whether the obtained differences are in reporting or actually in achievement.

A third finding was that the failure-expectancy groups reported significantly lower College Averages than did the success-expectancy groups. The above two explanations could be considered for this finding, and a third is also suggested: Since these data were collected at the end of the study, but prior to debriefing this finding might reflect the still potent effect of failure expectancy. It is also possible that the finding is an accident of sampling.

As was stated, further research will be necessary to determine which, if any, of the explanations is correct. Some support for the presence of actual differences in achievement can be found in the analysis of performance of problems 1 - 7 of EI and EII (all Ss solved problems 8 - 10 or were excluded from the sample).

On EI, rigid Ss solve significantly more problems than do non-rigid Ss. The implication would seem to be that the rigid are more concerned with getting right answers while the non-rigid are more concerned with exploration, i.e., finding their own creative way of doing things, even to the point of tolerating objective failure in order to do so. Rigidity, then, may be more efficient, in traditional academic terms, but perhaps at the expense of creativity. Further, this may indicate the non-rigid's willingness to define success and failure in his own way, rather than in the traditional "right answer" way: success for the non-rigid person may be in finding his own way of doing things through the exploration of alternatives.

On EII, following experimental manipulation, the rigids again solve significantly more problems than do the non-rigids. There is also a statistically insignificant trend ($p < .10$) for the NRF group to solve more problems correctly than does the NRS group. Thus, failure expectancy again tends to induce rigid-like behavior in the otherwise non-rigid, and rigidity can be seen to entail the restriction of creativity in service of objective achievement. The analysis of the change in number of correct solutions from EI to EII, although yielding no significant results, indicated the same trend.

Correlational analysis of the relationship between problems 1 - 7 of EI and EII produced significant results. The two forms of the test retain their significant relationship for all but the NRF group. This would seem to indicate that the NRF group is the only group to significantly alter its approach on EII, and the above analyses suggests that this alteration is in the direction of a cessation of exploratory behavior and an increased attempt at obtaining correct solutions.

While further research must be done to determine whether the obtained differences in High School and College performance are due to defensive reporting or actual achievement differences, the latter group of findings would seem to lend some support to the second of these alternatives. If this is indeed the case, it would appear that the structure of the current academic world is such as to discourage creativity and to encourage rote learning and non-creative thinking. This is a problem that has not gone unnoticed. As stated by Rogers (1971):

> It is my observation that traditional education is the most rigid, out-dated, bureaucratic, incompetent institution in our culture ... We rarely

> look at the real cause of educational unrest - namely that schools are so incredibly outdated that students no longer find them important ... It seems imperative to me that education must adopt a new goal. Suppose by a wave of a magic wand I could produce just one change and only one in our educational system: every teacher at every level would <u>forget</u> that he is a teacher. He would develop a complete amnesia for the teaching skills which he has painstakingly acquired over the years. But in place of these abilities he would find himself holding the attitudes, and possessed of the skills, of a facilitator of learning ... To me this is beautiful because every student - retarded, gifted, underprivileged, average - would be working on problems of real concern and interest to him and at the level at which he is able to grasp the material. He would have a continuing experience of success. He would have avoided the all too common torment of today, experienced by many, many students, whereby he learns day after day, in a multitude of ways, that he is a failure, a worthless being. (pp. 1,7).

Contrary to what would be expected from Rogers' remarks is the finding reported above that failure can serve as an enhancer of performance. Feather and Saville (1967) and others have shown failure to produce a decrement in subsequent performance. Kates and Barry (1970) did a study (see Introduction) wherein high failure-avoidant subjects' performance increased under conditions of failure feedback when such feedback was non-verbal. They assumed that the improvement was motivated by the subjects' striving to avoid failure when the opportunity for interpersonal shame was absent. The same situation obtained in the current study, i.e., feedback was non-verbal, but this is not held to account for the results. Mettee (1971) also found failure to enhance performance. This occurred when the probability of failure was seen as nearly certain. Zajonc and Brickman (1969) also found that failure could serve as an enhancer of subsequent performance when the subject did not drastically change his success expectancy following failure feedback.

None of these findings is inconsistent with the results of the current study. This investigation would seem to suggest, as was hinted at by Zajonc and Brickman, that expectancy, and so problem-solving approach, is an important determinant of subsequent performance. The finding presented above suggest that the induction of failure expectancy in this study enhanced performance, defined in the traditional sense, by arousing a defensive problem-solving strategy - rigidity - while curtailing creative problem-solving-alternative seeking. The findings of the study, taken together, suggest that rigidity is a defensive strategy engendered by pervasive failure expectancy in the achievement situation (e.g., rigids have higher TAQ scores than non-rigids. Howard and Slatus, 1966), which would seem to support such an interpretation. This is particularly true of the findings which show rigids, seen as higher in failure-avoidance, to solve more problems during testing.

Some of the findings reported above have been interpreted in terms of possible attribution of performance outcome. Further, some of the rationale for the current study was provided by achievement motivation theory, particularly the definition of TAQ scores as a measure of the motive to avoid failure. The results of the present study, particularly with regard to expectancies, seems to converge on the suggestion that attribution may be a defensive strategy dependent upon chronic expectancy. If this is so, Weiner and Kukla's (1970) attribution theory of achievement motivation would require some modification in order to reflect the importance of expectancy in determining the direction of attribution. This paper concludes with some suggestions for such modification of the theory propounded by Weiner and Kukla.

Weiner and Kukla's (1970) theory was presented in detail in the Introduction section of this paper, and will be briefly dealt with here through the presentation of the authors' attributional analysis of typical achievement motivation findings.

The most documented finding is that high need achievement people choose tasks of intermediate difficulty while low need achievement people choose extremely easy or difficult tasks. Weiner and Kukla suggest that the high nAch groups select tasks of intermediate difficulty because, being amenable to internal (rather than task) attribution, they provide the greatest feedback concerning ability (the authors make no attempt to explain why this is important) and, because of internal attribution, they get greater reward for attaining the goal. The authors picture the low need achievement person as one who wants to avoid information about ability and so will select very easy or very hard tasks, which allow outcome to be attributed to the task (external) rather than to ability. It seems clear that what the authors are describing is a defensive strategy, the direction of which must be cognitively mediated by some other factor. It is proposed that this mediator of attribution is expectancy with regard to performance in the achievement situation.

Thus, if the low need achievement individual didn't <u>expect</u> to fail why would he choose extreme tasks which allow for external attribution and thereby ego-defense?

The high need achievement person is also found to persist longer in the face of failure than does the low need achievement person. Weiner and Kukla explain this by positing that the high need achiever functions in this way because he is more likely to attribute failure to a lack of effort rather than to a lack of ability.

However, attribution of success to ability and of failure to lack of effort are both internal attribution, and both allow the person to keep a relatively stable, positive expectancy concerning his achievement-related performance. The high need achievement person, then, can be seen as one who generally expects to succeed. This expectancy is confirmed by the attribution of success to ability. It is also confirmed by the attribution of failure to lack of effort, as the person is really communicating that if he had tried harder, he had the ability to succeed. Thus, a general achievement-related expectancy can be hypothesized as mediating the defensive direction of outcome attribution. This is more easily seen in the low need achievement person, conceptualized herein as having a chronic failure expectancy which mediates his behaving in a way which minimizes the possibility of internal attribution.

Weiner and Kukla's explanation of the choice of tasks of intermediate difficulty is also open to expectancy interpretation. The authors state that such choices are mediated by desire for ability feedback. Is it not possible that the high need achievement person has a relatively stable success expectancy in the achievement situation which, as the current study demonstrates, is modifiable in a given situation, based upon experience, with the modification being only temporary and situation-specific. Because of his relatively stable self-confidence (and perhaps tolerance of ambiguity), such a person might simply enjoy the challenge of problem-solving, with objective failure posing no lasting threat to his self-esteem. (This is how the non-rigids seemed to behave except when failure expectancy was induced.)

Thus, both the high and low need achievers can be hypothesized to have relatively stable expectancies concerning their ability in the achievement-oriented situation. These expectancies can be seen as the determinants of achievement-related behaviors which underlie outcome attribution. Thus, generalized success expectancy vis-a-vis generalized failure expectancy can be hypothesized to mediate attribution, and thus to be more powerful in explaining achievement-oriented behavior than is attribution, which emerges as defensive strategy which depends upon expectancy. A modification of recent developments in achievement motivation theory is therefore suggested, taking explanatory power away from attribution and increasing the emphasis upon generalized expectancy of success or failure as determinants of achievement related behavior. (What underlies these expectancies is not even open to speculation at this time, except to suggest rootedness in childhood, perhaps as follows from the authoritarian personality theory summarized by Leach, 1967, and presented in the Introduction to this paper, as well as in the tremendous achievement pressure, as noted by Rogers (1971), traditionally evident in our culture.

While some of the suggested modifications of achievement motivation theory appear to follow from the current investigation, they must be considered as highly speculative, and are presented mainly as a suggestion for further research. Perhaps a critical study could be done by replicating the current study, adding measures of $M_s$, $M_{af}$, and of outcome attribution for each item.

The implications for education can be tested simply by establishing rigid and non-rigid groups for whom actual achievement data are available, and administering a series of tasks (perhaps replication of this study) followed by a questionnaire which will allow for a comparison of actual and reported achievement.

It is important to note that two conceptions of rigidity were used in this study: rigidity as a stable personality trait for the rigid person, and rigidity as a <u>temporary</u>, situationally determined mode of behavior for the non-rigid, contingent upon the arousal of failure expectancy. The theory is that the rigid is chronically failure expectant, and that his chronic expectancy is rather closed to modification by experience. The non-rigid, on the other hand, is seen as responsive to experience, and thereby capable of having a rigid approach to problem solving evoked through the induction of failure expectancy in a given situation. It is expected that this induced expectancy and rigid approach will terminate with the situation, and that the individual will approach his next situation once again open to experience. The implication is that rigidity in the problem solving situation is a reflection of an underlying personality trait: closedness to altering self-perception due to experience (rigid) vs. the openness to altering self-perception due to experience. The rigid person does not seem to come to function non-rigidly as a function of success or success expectancy, while the non-rigid person does seem capable of coming to behave rigidly in response to failure and failure expectancy. What is being dealt with, then, is _not_ personality vs. situational rigidity, but rather the definition of rigidity and non-rigidity in terms of respectively, closedness and openness to experience. _Behavior was modified in this study; the underlying personality trait, openness to experience vs. closedness to experience, was not modified_. Rigidity, defined in this manner (similar to Rokeach's 1960 point of view), can be viewed as a personality characteristic. The scope of this study does not warrant generalizing it beyond the achievement-oriented situation.

Of course, this raises a general question of the modifiability of personality traits. The tendency is to view such traits, or modes of organization, as rather stable components of a person's repertory of responses. Yet, those working in psychotherapy (even in behavior modification) are attempting to help a person alter just such "traits". Perhaps this general question could be approached by considering several such traits and determining what the effect is on them of different environmental conditions, particularly with regard to the effect on expectancy which appears to be an important, underlying cognitive mediator of change. Perhaps some traits are modifiable while others are not.

# TABLES OF RESULTS

TABLE 3

Comparison between male and female subjects on mean $PE_i$ and EI rigidity scores

| Group | PEi | EI |
|---|---|---|
| Males | 70.00 | 2.16 |
| Females | 65.00 | 2.13 |
| *t* | 1.77 | 0.15 |
| *p* | >.05 | >.05 |

TABLE 4a

Means of the experimental groups on EII scores

| Group | Failure | Success |
|---|---|---|
| Rigid | 2.60 | 2.80 |
| Non-Rigid | 1.04 | 0.77 |

TABLE4b

Analysis of variance for effect of experimental manipulation on EII scores

| Source | *df* | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 66.29 | 69.77 ** |
| Succ/Fail(B) | 1 | 0.05 | 0.05 |
| AxB | 1 | 1.46 | 1.54* |
| Error | 89 | 0.95 | |

* $p < .25$

** $p < .001$

TABLE 4c

Selected comparisons on EII scores by Scheffé method[1]

| Groups | *t* | *p* |
|---|---|---|
| NRS vs. NRF | 0.77 | >.05 |
| NRS vs. RS | 6.15 | <.05 |
| NRF vs. RF | 5.79 | <.05 |
| RS vs. RF | 0.08 | >.05 |

1 For this and all subsequent comparisons among the experimental groups, by the Scheffé method, any $t \geq 3.44$ is significant at the .05 level ( *df* = 1,89).

Table 5a

Mean change scores of the experimental groups from EI to EII (EII-EI)

| Group | Failure | Success |
|---|---|---|
| Rigid | -0.39 | -0.20 |
| Non-Rigid | 0.64 | 0.46 |

TABLE 5b

Analysis of variance for rigidity change scores, EII-EI

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 17.07 | 17.59* |
| Succ/Fail(B) | 1 | 0.05 | 0.052 |
| A x B | 1 | 0.77 | 0.79 |
| Error | 89 | 0.97 | |

*$p < .001$

Table 5c

Selected comparisons of EII-EI change scores by Scheffé method

| Groups | t | p |
|---|---|---|
| NRS vs. NRF | 0.57 | >.05 |
| RS vs. RF | 0.76 | >.05 |
| NRS vs. RS | 1.94 | >.05 |
| NRF vs. RF | 3.81 | <.05 |
| RS+RF vs. NRF+NRS | 4.05 | <.05 |

TABLE 6

Comparison of mean EII scores between Rigids and Non-Rigids not succesfully manipulated

| Group | Mean EII score |
|---|---|
| Rigid | 2.60 |
| Non-Rigid | 0.00 |
| <u>t</u> | 10.40 |
| <u>p</u> | $<.001$ |

TABLE 7

Mean number of non-Einstellung solution attempts made on problems 1-7 of EI and EII and mean change score from EI to EII

| Group | EI | EII | Change |
|---|---|---|---|
| RF | 0.24 | 0.09 | 0.15 |
| NRF | 1.14 | 1.27 | -0.14* |
| RS | 0.08 | 0.00 | 0.08 |
| NRS | 1.40 | 1.20 | 0.24 |

*Negative score means more non-Einstellung attempts were made on EII.

TABLE 7a

Analysis of variance for the number of non-Einstellung solution attempts made during problems 1-7 of EI

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 23.16 | 25.17* |
| Succ/Fail(B) | 1 | 0.00 | 0.00 |
| A x B | 1 | 0.91 | 1.00 |
| Error | 89 | 0.92 | |

*$p < .001$

TABLE 7b

Analysis of variance for the number of non-Einstellung solution attempts made during problems 1-7 of EII

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 29.68 | 28.27* |
| Succ/Fail(B) | 1 | 0.07 | 0.07 |
| A x B | 1 | 0.16 | 0.15 |
| Error | 89 | 1.05 | |

*$p < .001$

TABLE 7c

Analysis of variance for the change in the number of non-Einstellung solution attempts made, problems 1-7, EI-EII

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 0.24 | <1 |
| Succ/Fail(B) | 1 | 0.12 | <1 |
| A x B | 1 | 1.05 | <1 |
| Error | 89 | 1.34 | |

TABLE 7d

Correlations for the experimental groups between the number of non-Einstellung solution attempts made, problems 1-7 of EI and EII

| Group | r | p |
|---|---|---|
| RF | .43 | <.01 |
| RS | .46 | <.01 |
| NRF | .43 | <.05 |
| NRS | .14 | >.05 |

TABLE 8a

Mean $PE_i$ scores for the experimental groups

| Group | Failure | Success |
|---|---|---|
| Rigid | 70.90 | 63.60 |
| Non-Rigid | 65.00 | 65.40 |

TABLE 8b

Analysis of variance for $PE_i$ scores

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 181.0 | 6.5* |
| Succ/Fail(B) | 1 | 453.0 | 16.3*** |
| A x B | 1 | 307.2 | 11.1** |
| Error | 89 | 27.8 | |

*$p < .05$
**$p < .01$
***$p < .001$

TABLE 8c

Selected comparisons of $PE_i$ scores by Scheffé method

| Groups | *t* | *p* |
|---|---|---|
| RS+RFvs. | | |
| NRS+NRF | 1.85 | $> .05$ |
| NRS vs. NRF | 0.22 | $> .05$ |
| RS vs. RF | 5.21 | $< .05$ |
| RF vs. NRF | 4.13 | $< .05$ |
| RS vs. NRS | 1.oo | $> .05$ |

TABLE 9

Comparison of mean $PE_i$ scores of unsuccessfully manipulated Ss

| Group | Mean $PE_i$ |
|---|---|
| Rigid | 70.00 |
| Non-Rigid | 62.00 |
| *t* | 1.02 |
| *p* | >.10 |

TABLE 10

Comparison of the sexes on PE for problem 1 of Anagrams

| Group | Mean $PE,A_1$ |
|---|---|
| Males | 62.42 |
| Females | 62.47 |
| *t* | 0.06 |
| *p* | >.05 |

TABLE 11a

Mean change in PE from task to task prior to manipulation $\frac{(PE_1-PEEI_1+PEA_1)}{2}$

| Group | Failure | Success |
|---|---|---|
| Rigid | 5.5 | -2.8 |
| Non-Rigid | -1.8 | 3.1 |

TABLE 11b

Analysis of variance for the change in PE from task to task prior to manipulation

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 89.3 | 0.5 |
| Succ/Fail(B) | 1 | 260.8 | 1.3 |
| A x B | 1 | 904.2 | 4.6* |
| Error | 89 | 194.7 | |

*$p < .05$

TABLE 11c

Selected comparisons of PE changes from task to task prior to manipulation by Scheffé method

| Groups | *t* | *p* |
|---|---|---|
| RF vs. NRF | 1.9 | $>.05$ |
| RS+RF vs. NRS+NRF | 1.1 | $>.05$ |

TABLE 11d

Chi-square for data of TABLE 11b: observed and expected frequencies of PE rising, falling, or not changing from task to task

| Group | Rise O | Rise E | Fall O | Fall E | Same O | Same E | $\chi^2$ |
|---|---|---|---|---|---|---|---|
| RF | 7 | 11.35 | 19 | 13.13 | 7 | 8.52 | |
| RS | 10 | 8.60 | 3 | 9.95 | 12 | 6.45 | |
| NRF | 11 | 7.57 | 7 | 8.75 | 4 | 5.68 | |
| NRS | 4 | 4.47 | 8 | 5.17 | 1 | 3.35 | 20.08* |

*$p < .01$

TABLE 11e

Comparison between Rigids and Non-Rigids not successfully manipulated, on PE changes from task to task

| Group | Mean PE change |
|---|---|
| Rigid | 1.5 |
| Non-Rigid | -1.0 |
| $t$ | 1.08 |
| $p$ | $>.1$ |

TABLE 11f

Chi-square for data of TABLE 11e

| Group | Rise o | Rise E | Fall O | Fall E | Same O | Same E | $\chi^2$ |
|---|---|---|---|---|---|---|---|
| Rigid | 2 | 2 | 3 | 2 | 5 | 6 | |
| Non-Rigid | 1 | 1 | 0 | 1 | 4 | 3 | 2.00* |

*$p > .30$

TABLE 12

Mean average change in PE during problems 1-7 of EI and EII

| Group | EI | EII |
|---|---|---|
| RF | -8.4* | 24.3 |
| NRF | -7.3 | 13.9 |
| RS | 6.7 | 3.9 |
| NRS | -15.1 | -19.5 |

*Negative score means PE decreases during task.

TABLE 12a

Analysis of variance for the difference between the average PE for problems 8,9,and 10 and problem 1 of EI

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 3,390.69 | 4.69* |
| Succ/Fail(B) | 1 | 85.09 | 0.12 |
| A x B | 1 | 1,223.91 | 1.69 |
| Error | 89 | 722.36 | |

*$p < .05$

TABLE 12b

Selected Scheffé comparisons of PE changes during EI

| Groups | $t$ | $p$ |
|---|---|---|
| RS+RF vs. NRS+NRF | 4.9 | <.05 |
| RS vs. RF | 1.06 | >.05 |
| NRS vs. NRF | 0.83 | >.05 |
| RS vs. NRS | 2.37 | >.05 |
| RF vs. NRF | -0.87 | >.05 |

TABLE 12 c

Comparison between Rigids and Non-Rigids, not successfully manipulated, on PE changes during EI

| Group | PE change during EI |
|---|---|
| Rigid | -4.67 |
| Non-Rigid | -4.00 |
| t | 0.11 |
| p | >.5 |

TABLE 12d

Analysis of variance for PE changes during EII

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 5,690.40 | 9.7* |
| Succ/Fail(B) | 1 | 14,007.27 | 23.8** |
| A x B | 1 | 887.74 | 1.5 |
| Error | 89 | 587.67 | |

*$p < .01$

**$p < .001$

TABLE 12e

Selected comparisons by Scheffé method of PE changes during EII

| Groups | t | p |
|---|---|---|
| RS+RF vs. NRS+NRF | 6.88 | <.05 |
| RF+NRF vs. RS+NRS | 4.45 | <.05 |
| RF vs. RS | 3.17 | >.05 |
| NRF vs. NRS | 3.88 | <.05 |
| RF vs. NRF | 1.41 | >.05 |
| RS vs. NRS | 2.82 | >.05 |

TABLE 12f

Comparison between Rigids and Non-Rigids, not successfully manipulated, on PE changes during EII

| Group | PE change during EII |
|---|---|
| Rigid | 11.00 |
| Non-Rigid | -2.00 |
| *t* | 2.34 |
| *p* | $<.05$ |

TABLE 13

Means of the experimental groups on average PE change on problems 1-7 of EI and EII, number of such changes greater than one scale point, total number of PE changes, and change scores from EI to EII for each variable

| Group | Av. PE change | | | # changes >1 | | | Total PE changes | | |
|---|---|---|---|---|---|---|---|---|---|
| | EI | EII | Ch. | EI | EII | Ch. | EI | EII | Ch. |
| RF | 13.13 | 10.71 | 2.42 | 1.60 | 1.39 | 0.21 | 3.30 | 3.00 | 0.30 |
| NRF | 11.13 | 7.58 | 3.56 | 1.45 | 0.77 | 0.68 | 3.45 | 2.73 | 0.73 |
| RS | 8.33 | 9.13 | -0.80 | 0.92 | 1.04 | -0.12 | 2.76 | 2.96 | -0.20 |
| NRS | 9.88 | 9.61 | 0.26 | 1.08 | 1.31 | -0.23 | 3.08 | 3.23 | -0.15 |

TABLE 13a

Analysis of variance for the average PE change during problems 1-7 of EI

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 8.01 | 0.11 |
| Succ/Fail(B) | 1 | 276.00 | 3.81* |
| A x B | 1 | 65.39 | 0.90 |
| Error | 89 | 72.42 | |

*$p < .1$

TABLE 13b

Analysis of variance for the average PE change during problems 1-7, EII

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 63.67 | 0.895 |
| Succ/Fail(B) | 1 | 1.60 | 0.02 |
| A x B | 1 | 67.61 | 0.95 |
| Error | 89 | 71.10 | |

TABLE 13c

Analysis of variance for the number of PE changes greater than 1 scale point (10) on problems 1-7 of EI

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 0.44 | 0.23 |
| Succ/Fail(B) | 1 | 7.60 | 4.02* |
| A x B | 1 | 0.26 | 0.14 |
| Error | 89 | 1.89 | |

*$p < .05$

TABLE 13d

Analysis of variance for the number of PE changes greater than 1 scale point on problems 1-7 of EII

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 1.60 | 1.00 |
| Succ/Fail(B) | 1 | 0.01 | 0.006 |
| A x B | 1 | 4.11 | 2.58* |
| Error | 89 | 1.59 | |

*$p < .1$

TABLE 13e

Analysis of variance for the total number of PE changes made during problems 1-7 of EI

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 0.99 | 0.32 |
| Succ/Fail(B) | 1 | 5.19 | 1.67 |
| A x B | 1 | 0.16 | 0.05 |
| Error | 89 | 3.10 | |

TABLE 13f

Analysis of variance for the total number of PE changes made during problems 1-7 of EII

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 0.10 | 0.03 |
| Succ/Fail(B) | 1 | 0.58 | 0.19 |
| A x B | 1 | 1.51 | 0.51 |
| Error | 89 | 2.98 | |

TABLE 13g

Analysis of variance for change in average magnitude of PE change from EI to EII (Problems 1-7)

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 26.56 | 0.31 |
| Succ/Fail(B) | 1 | 237.04 | 2.80* |
| A x B | 1 | 0.04 | 0.0005 |
| Error | 89 | 84.58 | |

*$p = .1$

TABLE 13h

Analysis of variance for changes from EI to EII in the number of PE changes greater than one scale point during problems 1-7

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 1.27 | 0.62 |
| Succ/Fail(B) | 1 | 6.63 | 3.16* |
| A x B | 1 | 1.74 | 0.83 |
| Error | 89 | 2.10 | |

*$.1 > p > .05$

TABLE 13i

Analysis of variance for changes from EI to EII in the total number of PE changes made, problems 1-7

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 1.95 | 0.65 |
| Succ/Fail(B) | 1 | 9.50 | 3.18* |
| A x B | 1 | 0.75 | 0.25 |
| Error | 89 | 2.99 | |

*$.1 > p > .05$

TABLE 14

Mean reported High School average, number of college courses failed, and college average

| Group | H.S. AV. | # Failed | Col. Av. |
|---|---|---|---|
| RF | 83.96 | 0.36 | 2.54 |
| NRF | 82.38 | 0.73 | 2.51 |
| RS | 86.46 | 0.28 | 2.87 |
| NRS | 81.84 | 0.54 | 2.58 |

TABLE 14a

Analysis of variance for reported High School Average

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 167.65 | 7.18* |
| Succ/Fail(B) | 1 | 46.11 | 1.97 |
| A x B | 1 | 47.94 | 2.05 |
| Error | 89 | 23.36 | |

*$p < .01$

TABLE 14b

Analysis of variance for the number of college courses reported failed

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 2.32 | 4.14* |
| Succ/Fail(B) | 1 | 0.44 | 0.79 |
| A xB | 1 | 0.00 | 0.00 |
| Error | 89 | 0.56 | |

*$p < .05$

TABLE 14c

Analysis of variance for reported college average

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 0.36 | 1.8 |
| Succ/Fail(B) | 1 | 1.22 | 6.1* |
| A x B | 1 | 0.35 | 1.8 |
| Error | 89 | 0.20 | |

*$p < .05$

TABLE 15

Mean number of correct solutions on problems 1-7 of EI

| Group | Failure | Success |
|---|---|---|
| Rigid | 4.80 | 4.80 |
| Non-Rigid | 4.09 | 3.50 |

TABLE 15a

Analysis of variance for the mean number of correct solutions on problems 1-7 of EI

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 18.74 | 4.57* |
| Succ/Fail(B) | 1 | 0.94 | 0.23 |
| A x B | 1 | 1.60 | 0.39 |
| Error | 89 | 4.10 | |

*$p < .05$

TABLE 16

Mean number of correct solutions on problems 1-7 of EII

| Group | Failure | Success |
|---|---|---|
| Rigid | 5.90 | 5.60 |
| Non-Rigid | 4.64 | 3.70 |

TABLE 16a

Analysis of variance for the mean number of correct solutions on problems 1-7 of EII

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 48.34 | 23.58** |
| Succ/Fail(B) | 1 | 5.91 | 2.88* |
| A x B | 1 | 2.18 | 1.06 |
| Error | 89 | 2.05 | |

**$p < .001$

*$p < .10$

TABLE 17

Mean change in number of correct solutions achieved on problems 1-7, EI to EII

| Group | Failure | Success |
|---|---|---|
| Rigid | 1.09 | 0.76 |
| Non-Rigid | 0.64 | 0.15 |

TABLE 17a

Analysis of variance for the data of TABLE 17

| Source | df | MS | F |
|---|---|---|---|
| Rigidity(A) | 1 | 5.77 | 1.56 |
| Succ/Fail(B) | 1 | 3.35 | 0.91 |
| A x B | 1 | 0.10 | 0.03 |
| Error | 89 | 3.70 | |

TABLE 18a

Correlation between the number of correct solutions during problems 1-7 of EI and EII

| Group | r | p |
|---|---|---|
| RF | .51 | <.01 |
| RS | .43 | <.02 |
| NRF | .20 | >.20 |
| NRS | .76 | <.01 |

TABLE 18b

T test comparisons between correlation coefficients shown in TABLE 18a

| Groups | t | p |
|---|---|---|
| RS vs. RF | 0.15 | >.05 |
| NRS vs. NRF | 2.07 | <.05 |
| RS vs. NRS | 2.40 | .02 |
| RF vs. NRF | 2.40 | .02 |

TABLE 19

Mean number of anagrams solved correctly by those whose expectancies went opposite to manipulation

| Group | Fail/Easy | Succ/Hard |
|---|---|---|
| Rigid | 5.47 | 6.10 |
| Non-Rigid | 5.20 | 5.50 |

TABLE 20

Mean $PE_i$ for those whose expectancies went opposite to manipulation

| Group | Fail/Easy | Succ/Hard |
|---|---|---|
| Rigid | 70.00 | 57.00 |
| Non-Rigid | 68.00 | 60.00 |

Table 22

Mean $PE_i$, by sex, of those whose expectancies went opposite to manipulation plan.

| Group | Mean $PE_i$ |
|---|---|
| Male | 61.1* |
| Female | 67.3 |

*Difference N.S, due largely to small number of males (9), with large variability. Female N=27.

Table 23

Sex differences in $PE_i$ and EI scores for subjects in the experimental groups. N=93.

| Group | Mean $PE_i$ | Mean EI |
|---|---|---|
| Males | 71.5 | 2.06 |
| Females | 63.7 | 2.00 |
| *t* | 2.4 | .21 |
| *p* | $< .05$ | $> .05$ |

Table 24

Mean $PE_i$, by sex, combining data of tables 22 and 23

| Group | Mean $PE_i$ |
|---|---|
| Male | 69.2* |
| Female | 64.8 |

*Difference of 4.4 N.S.

# APPENDIX

# Appendix A

## Oral Instructions Presented to Ss

A. General Introduction:

You will be asked to solve some arithmetic and verbal problems to help establish nationwide college norms. You will not be asked to give your names; just code numbers will be used.

No one is required to participate, but if you decide to help, please take it seriously. Fooling around or looking at someone else's work could spoil the results.

The general instructions are as follows: Please follow directions precisely, do not change any answers after the allotted time for a problem has elapsed, do not go back to rework or refinish a previous problem, do not go ahead in your test booklet until instructed to do so, and do not look at anyone else's work. It is also important that no comments be made or questions asked from this point until the study is over.

B. Probability Estimates:

It has been found that such factors as confidence, perception of task difficulty, etc., are important in performance on these tasks. You will, then, be asked some questions pertaining to such factors. Reminding you that your answers will be anonymous, do please answer all questions as truthfully as you can.

Please take your booklet marked Test I. You will find at the bottom of the face sheet the question "What do you feel are your chances of doing well on these tests."

You are to answer this and all similar subsequent questions by circling the number on the scale below the question which you believe reflects your probability of success. Please circle that number now. (Put a circle around the number that shows what you think about your chances of doing well.)

Please turn to the next page in this booklet and read the information at the top as I read it aloud to you. (Read). Will you now make the required probability of success estimate by encircling the appropriate number on the scale.

c. <u>EI</u>: These arithmetic problems are all of the same type. Here is an example (Problem A put on the blackboard). Here are 3 imaginary jars. The first can hold 13 quarts, the second 29 quarts, and the third 3 quarts. The jars are empty. Assuming that you have an unlimited supply, how would you go about measuring out <u>exactly</u> 10 quarts. This can be solved by filling the second jar (B) and from it filling jar A once and jar C twice. That is B - A - 2C = 29 - 13 - 2 (3) = 10. You need not make use of all the jars in your solutions, and you may write your solutions in words or arithmetically, as you wish. Speed is an important factor, and you will be given only <u>30 seconds</u> per problem. Do not turn any pages until you are told to do so, and do not go back to a previous problem to change an answer or to fill in one you left out.

If you are failiar with these problems, please write the word "familiar" on the first page, but continue taking the test anyway.

Following the 30 seconds for each problem: Now make the probability estimate for the next problem (5 seconds). Turn to the next problem and begin. (Assistant collects booklets while Test II is introduced).

D. Anagrams Test: Now take the booklet marked Test II. Please read the instructions to yourselves as I read them aloud. There are two forms to this test; you will not all have the same one. (Read). Please detach the answer sheets (last page of booklet). After each problem, S will be reminded to make his probability estimate for the next problem and to copy his solution from the test booklet onto his answer sheet. (Assistant collects booklets while "norms" are being explained).

Now take the sheet, folded over and stapled, which was attached to this booklet, and open it. This sheet contains the correct answers to your anagrams test. Please follow the instructions on the sheet and enter the required information. (Assistant collects as Test III is explained.)

E. Test III, EII: Now take the booklet marked Test III. Read the directions as I read them aloud. (Prob. estimate 1 made).

These problems are similar to Test I; let me give you an example to refresh you. (Problem A on blackboard). Here again are three imaginary jars. The first can hold 10 quarts, the second 40 quarts, and the third 90 quarts. How would you go about measuring out exactly 70 quarts?

This can be solved by filling the third jar, and from it filling the second jar once and the first jar twice. That is, C - B - 2A = 90 - 40 - 2(10) = 30. You need not use all the jars in your solutions, and you may write your solutions in words or arithmetically, as you wish. Speed is again important, and you will be given <u>only 30 seconds</u> per problem.

Following the 30 seconds for each problem, <u>S</u>s will be instructed to make the probability estimate for the next problems (<u>5 seconds</u>). Turn to the next problem and begin.

After problem 10, <u>S</u>s will be asked to turn to the next page and answer the few brief questions theron.

## Appendix $B_1$

Code No.__________

### Anagram Test Solutions: Form A

| Problem | Solution | Problem | Solution |
|---|---|---|---|
| 1 | judge | 6 | flood |
| 2 | water | 7 | clerk |
| 3 | voice | 8 | labor |
| 4 | bacon | 9 | funny |
| 5 | uncle | 10 | train |

Below appear the norms so far collected for the Anagrams Tests at various colleges. Check your answer sheets against the correct solutions listed above. Please count the number of anagrams you solved correctly and enter that number in the appropriate space below. Then locate your score in the "Number Correct" column and enter the corresponding percentile rank in the appropriate space below.

| Number Correct | Percentile Rank |
|---|---|
| 7-10 | 99 |
| 6 | 84 |
| 5 | 50 |
| 2-4 | 25 |
| 1 | 10 |
| 0 | 0 |

Number Correctly Solved __________ Percentile Rank __________

## Appendix $B_2$

Code No.__________

### Anagram Test Solutions: Form B

| Problem | Solution | Problem | Solution |
|---|---|---|---|
| 1 | ghoul | 6 | baton |
| 2 | peony | 7 | train |
| 3 | tango | 8 | triad |
| 4 | funny | 9 | incur |
| 5 | water | 10 | agile |

Below appear the norms so far collected for the Anagram Test at various colleges. Check you answer sheets against the correct solutions listed above. Please count the number of anagrams you solved correctly and enter that number in the appropriate space below. Then locate your score in the "Number Correct" column and enter the corresponding percentile rank in the appropriate space below.

| Number Correct | Percentile Rank |
|---|---|
| 7-10 | 99 |
| 6 | 84 |
| 5 | 50 |
| 2-4 | 25 |
| 1 | 10 |
| 0 | 0 |

Number Correctly Solved __________ Percentile Rank __________

## Appendix C

Dear Student:

Thank you for participating in our study. This is to inform you of the true nature of the experiment.

The idea is simply that different people have different approaches to solving problems. Some people find a way that works and stick to it, while others are always looking for new ways. Neither way is "better" than the other; they are just different ways of approaching the same task.

This study was designed to see whether success or failure experiences would affect a person's problem solving approach. The two forms of the Anagram Test were deliberately designed so that half of you would pass at least 7 while the other half would fail at least 7. The norms with which you were presented were completely fictitious. Thus, your performance in this study was solely a function of experimental manipulation and in no way reflects your ability, either positively or negatively.

Thank you again for your cooperation.

George Howard

## Appendix D

### Instructions to Ss Appearing on Test Booklets

Test I (EI): The test you are about to take is one of general arithmetic ability. Try to do your best as your scores will be taken as an accurate estimate of your ability. Start when so instructed, stop at the stop signal, do not turn back to a previously done problem to change your answer, and do not turn ahead in your booklet until so instructed.

Test II (Anagrams): The test you are about to perform is one of verbal intelligence. Please try to do your best as your scores are to be taken as a true and accurate indication of your intelligence level, particularly of your ability to deal with verbal materials. The test consists of a set of disarranged words (anagrams). Your task is to rearrange each group of letters so that they make a meaningful English word. You will have 30 seconds to work at each anagram. Start when so instructed, stop at the stop signal, do not turn back to a previous problem, and do not go ahead in your booklet until told to do so.

After writing your solution to each problem in this booklet, please copy the solution onto the separate sheet which you may now detach from the last page of this booklet. Remember, then, that your solution is to be written in 2 places.

Test III (EII): The next test is an arithmetic test somewhat like the first one you took. Although dissimilar in appearance, performance on this test correlates very highly with performance on the Anagram Test. People usually do about as well or as poorly on this test as they did on the Anagrams Test.

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