

The Relationship between Achievement Motivation, Anxiety, and Situational Characteristics on Performance on a Cognitive Task

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This report examines the independent and interactive contributions of achievement motivation and anxiety to performance on a cognitive task. Experimental manipulations of expectancy of success and presentation rate were selected as situations to arouse these personality variables. The results indicated that the positive effects of achievement motivation were constant regardless of situational manipulations, but under some circumstances situations facilitated performance in an additive manner. Anxiety had a differential effect on performance contingent upon levels of achievement motivation. These results offer some support for the framework outlined by M. S. Humphreys and W. Revelle (1984, *Psychological Review*, 91, 153-184). © 1988 Academic Press, Inc.

In recent years there has been a growing trend in research to view behavior as a function of both situational and personal factors. This approach seeks to identify the ways in which individual differences in personality and situational variability independently and interactively combine to produce behavior. The development of this interactionist perspective parallels the larger movement in psychology toward a focus on cognition. It is therefore not surprising that personality psychologists should seek to understand cognition from the interactionist perspective. For example, research of this kind has shown that personality characteristics (e.g., mood) influence the amount and type of information individuals integrate into their memory system (Ingram, Smith, & Brehm, 1983; Staats & Burns, 1982; Wertheim & Schwartz, 1983).

Achievement motivation and anxiety were selected for this study because

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of their conceptual relatedness. Each can be conceptualized as a source of arousal that stimulates individuals to action. Given the nature of both these variables (Atkinson & Litwin, 1960; Broadhurst, 1959; Feather, 1961; Sarason, 1963), it is conceivable that during many cognitive tasks (e.g., test taking) both sources of arousal may be operating simultaneously. It is striking that more integrative research on the relationships between these two variables has not been performed. Only recently with the work of Humphreys and Revelle (1984) has any systematic, theoretical explication of the possible relationships between these two variables been attempted.

The Humphreys and Revelle model attempts to posit the relative contributions of personality variables, situational factors and personal abilities in predicting performance on cognitive tasks. Previous research in this area has evidenced an inverted-U relationship between certain person and performance variables (Broadhurst, 1959). Humphreys and Revelle discuss the need to delineate such arousal-performance curves into two or more monotonic processes, where at least one increases with increments in arousal and the others decrease with increased activation. As they point out, curvilinear models of arousal are merely descriptive and do not provide any explanations for the effect. More reductionistic models have ". . . the advantage that they specify the task or kinds of tasks in which performance increments or decrements can be expected" (p. 159). To accomplish this they suggest researchers should include a third variable which may moderate these relationships. This variable may be organismic or situational, the impetus being in either case to promote greater precision in explicating the linkage between person and situation processes and their impact on performance. "A strategy we would like to recommend is the inclusion of a third variable . . . [possibly] to look at the effects of two personality dimensions and of an effort or arousal manipulation" (p. 179).

A major purpose of the present study was to apply the suggestions of Humphreys and Revelle in examining cognitive performance, specifically, to examine the effects of anxiety on performance over different levels of achievement motivation under varying situational conditions (the moderating variable here being levels of achievement motivation). This study includes two experimental manipulations that were deemed relevant to the examination of these two personality variables. The first was expectancy of success. As Feather (1961) has shown, varying the degree of a subject's perceived chances of success has differential effects on performance over levels of achievement motivation. In particular, tasks of intermediate difficulty are most conducive to highly achievement motivated individuals, while more extreme tasks (i.e., very easy or very difficult) do not enhance their performance. Probability of success levels of .9 (very easy) and .5

(moderate difficulty) were included to capture individual differences in achievement motivation.

Presentation rate was included as a manipulation for anxiety. Varying the speed at which subjects heard the passage (very slowly or quickly) would directly affect the amount of difficulty subjects would have in understanding the presented material. Given that all subjects were informed that they would be tested on their understanding of the passage (the evaluative nature of this statement would in itself arouse some level of anxiety, Sarason, 1984), the more quickly the passage was presented the more difficult it would be to extract the information, thus stimulating higher levels of anxiety.

The aim of this exploratory study is to provide an empirical articulation of the role of situational and personality variables in influencing performance on a cognitive task. There are three goals: (1) to examine the effects of personality variables over situations; (2) to determine which learning situations amplify and/or dampen the effects of such personality characteristics; and (3) using Humphreys and Revelle's suggestions, to examine the effects of anxiety on performance over different levels of achievement motivation.

METHOD

Subjects. Subjects consisted of 135 introductory psychology students (88 females and 47 males), all of whom volunteered and received course credit for their participation. Subjects ranged in age from 18 to 21.

Measures. The experimental instructions as well as the passage to be heard were presented via tape recorder. All subjects received a 24-question, multiple-choice recognition task that tested their understanding of the presented passage. Twelve questions related to the specific factual content (e.g., "According to the text, subjects showed what type of need to dream?") and twelve items related to their conceptual understanding of the passage (e.g., "Another title for this passage could be?"). The text was a 375-word passage on dreaming taken from an introductory psychology text.¹

The cognitive task embodied qualities (e.g., fact retention, synthetic-analytic abilities) that have been shown to be related to levels of achievement motivation (Schmeck & Grove, 1979). Since college students were being used as subjects, a memory task was selected

¹ Since the selected passage contained basic information about dreaming and subjects would be drawn from introductory psychology courses, we had to first determine if performance on the recognition task was due to having read the passage first and not to prior knowledge about dreaming. A separate group of 54 subject-pool students was randomly assigned to one of two conditions: reading the passage prior to completing the recognition task or answering the items on the recognition task without prior exposure to the text. Performance on both the factual and conceptual content items were clearly dependent upon reading the text (factual: $F(1, 52) = 82.64, p < .00005$; conceptual: $F(1, 52) = 17.08, p < .0001$). Reliability coefficients were also determined for the recognition task. Based on the responses by the 135 subjects in this sample, an overall $\alpha = .73$ was obtained. The α for the factual section was .50 and for the conceptual section was .62. All three coefficients were quite adequate for the purposes of this study.

because we felt that the ability to absorb and retain information would more closely parallel the tasks achievement-motivated individuals confront in an academic setting. This would make the task more relevant to them.

All subjects completed the achievement scale of the Edwards Personal Preference Schedule (EPPS; Edwards, 1959), the Adjective Check List (ACL, which provided a second measure of achievement motivation; Gough & Heilbrun, 1980), and the Spielberger State-Trait Anxiety Inventory. The achievement scales of both the EPPS and ACL have been shown to possess adequate construct validity (Bendig, 1959; Edwards & Waters, 1983; Gough & Hall, 1975; Izard, 1962; Krug, 1959; Steers, 1975). These studies have shown the effectiveness of these scales in predicting the academic performance of graduate and undergraduate students. Every attempt was made to use measures that would be relevant to a college population.

Procedure. Subjects completed the personality measures prior to hearing the passage. Upon completion of these materials, subjects were randomly assigned to one of the four experimental conditions formed by the orthogonal combination of the two independent variables (expectancy and presentation rate).

Subjects then received the instructions relevant to their experimental group. These instructions were presented by a tape-recorded voice. The instructions were (those words in parentheses were given to the low-expectancy groups):

In a few moments you will be hearing a passage. Please pay attention to my voice as I read it to you. After hearing this passage, you will be asked to complete a recognition task which will test your understanding of the presented material. Previous subjects have found this task to be very easy (difficult). Most subjects got at least 90% (50%) of the questions (in)correct.

The passage was presented at two varying speeds. In the fast group the passage lasted approximately 2 min while the slower reading was about 4 min in duration. Following the completion of the recognition task, subjects were debriefed. The dependent variables were the number of correct responses on the factual and conceptual parts of the recognition task.

RESULTS

The EPPS was related to recognition task performance in males, while the ACL scale was related to performance in females. Though these two achievement measures were independent of each other (in males, $r = .05$; in females, $r = .03$), a composite of the two measures was created by converting each score to a z and adding them together. This composite was related to performance in both genders.² State and trait anxiety were found to be highly correlated (in males, $r = .51$, $p < .05$; in females, r

² Research has indicated that males and females have different achievement orientations (i.e., they evaluate and interpret the outcomes of their achievement behaviors differently; Gaeddert, 1985; Veroff, 1977). The small correlations between these scales does not argue against their psychometric integrity; rather, both measures validly capture nonredundant aspects of a larger construct. These orthogonal elements are related to gender differences in achievement orientation (see Piedmont, DiPlacido, & Keller, 1988, for a fuller discussion). Creating a composite score served the purpose of establishing one variable that transcended these gender differences.

TABLE 1
CORRELATION MATRIX OF PERFORMANCE AND PERSON VARIABLES FOR MALES AND FEMALES

Variable	1	2	3	4
1. Conceptual	—	.49**	.27*	-.17
2. Factual	.28**	—	.28*	-.05
3. Composite achievement	.24**	.30**	—	.07
4. Composite anxiety	.07	-.08	.15	—

Note. Males are above the diagonal and females are below. Males = 47, females = 88.
* $p < .10$; ** $p < .05$.

= .51, $p < .05$). This high correlation offered an opportunity to assess a broader aspect of anxiety. Combining both scales would provide a measure that was less state and trait anxiety and more a general index of arousal. Further, this hybrid, which is based on two scores, should prove more robust than either measure alone. This new scale was calculated in the same manner as done for the achievement scales. These composite scores were used in all further analyses. Table 1 presents the correlation matrix for these person and performance measures.

Stepwise multiple regression analyses were used in the evaluation of the data for 135 subjects. Figures 1 and 2 graphically present these results.³ The variables of anxiety, achievement motivation, expectancy, presentation rate, and gender, plus their two-way interactions, were all tested for entry. Performance on the conceptual and factual content areas will be considered separately.

Conceptual Performance

Regression analyses indicated significant main effects for gender ($F(1, 129) = 6.9, p < .01$), the achievement composite ($F(1, 129) = 7.54, p < .01$), expectancy ($F(1, 129) = 3.9, p < .05$), and a significant interaction between gender and presentation rate ($F(1, 129) = 6.5, p < .01$). Figure 1 illustrates these results.

Achievement scores were positively associated with conceptual performance. In addition, subjects anticipating a moderately difficult task (probability of success equaling .5) answered more items correctly than did subjects in the high-expectancy conditions (probability of success

³ The regression equations were used in plotting these graphs, and they are presented with each figure. With regard to the person variables, three values were included in the analyses: the mean, the value 1 *SD* above the mean, and the value 1 *SD* below the mean. These values, along with the 0-1 dichotomies for presentation rate and expectancy, plus their interactions, were the components for all calculations.

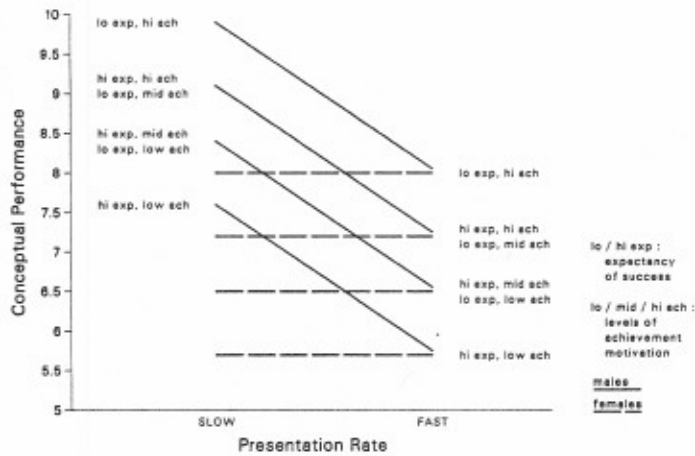


FIG. 1. Relationship between achievement motivation, expectancy, presentation rate, and gender on conceptual performance. Conceptual = .96 (gender) + .068 (achievement composite) + .0021 (presentation) - .36 (expectancy) - .92 (gender × presentation) + 3.53.

equaling .9). These two effects combined additively so that subjects with high scores on the achievement composite who were led to expect a moderately difficult task performed best, while the poorest performance came from subjects with low achievement scores who anticipated an easy task. The main effect for gender involved males scoring higher than females; the source of this effect is illustrated in the gender × presentation interaction. In the fast presentation conditions, there were no sex differences in performance; however, males answered more items correctly in the slow presentation conditions. In other words, rate of presentation had no effect on females while a slow presentation rate did facilitate performance for males.

Factual Performance

As with conceptual performance, there was a main effect for achievement motivation ($F(1, 130) = 9.5, p < .01$). As achievement motivation increased, so too did performance on these items. There was also a significant presentation by anxiety interaction ($F(1, 130) = 4.0, p < .05$), indicating that anxiety has a deleterious effect on performance for subjects in the fast presentation conditions. It appears that anxiety negatively influences the cognitive processing of superficial aspects of a written text. In an easy learning situation, levels of anxiety appear to have no influence upon performance. These results are presented in Fig. 2. The role of anxiety is more fully elaborated in the next section.

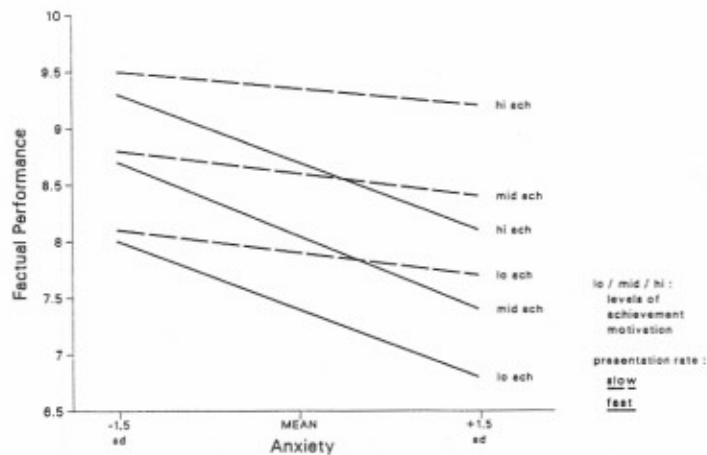


FIG. 2. Relationship between achievement motivation, anxiety, and presentation rate on factual performance. Factual = $.062$ (achievement composite) + 1.05 (presentation) - $.0079$ (anxiety composite) - $.033$ (presentation \times anxiety composite) + 6.09 .

Anxiety and Achievement Motivation

High- and low-achievement groups were formed by selecting subjects in approximately the upper and lower third of the composite distribution. For each group, composite anxiety scores were correlated to both performance measures. For high achievers there was a positive relationship (conceptual scores: $r(34) = .29, p < .05$; factual scores: $r(34) = .26, p < .06$). For those low on achievement motivation, there was a significant negative relationship on the factual dimension (factual scores: $r(39) = -.14, p = \text{n.s.}$; factual scores: $r(39) = -.29, p < .05$). The differences between these two sets of correlations are significant (z conceptual = $1.85, p < .06$, two-tailed; z factual = $2.37, p < .02$, two-tailed), indicating that the relationship between performance and anxiety reverses over levels of achievement motivation.

These findings suggest that overall increases in anxiety appear to facilitate performance for high achievement-motivated individuals, particularly on conceptual performance, while such arousal has a deleterious effect on performance for low achievers, particularly on factual performance.

DISCUSSION

The most consistent finding was the generally facilitative effect of achievement motivation which was positively associated with task performance regardless of the specific details of the task (i.e., conceptual or factual items) or situation. Expectancy affected performance only on the conceptual items. Subjects who were led to expect a more difficult

task performed better on the conceptual items. Since the conceptual content appears to be the object of the subjects' attention regardless of instructions,⁴ we suggest that expecting a difficult task facilitates performance *only* with content that is attended to, while achievement motivation facilitates performance beyond the immediate focus of attention.

It appears then that two independent mechanisms are operating to facilitate performance, thus their additive effect. These data suggest that achievement motivation influences performance on both the conceptual and factual dimensions. However, the influence of the cognitive processes of appraisal are more situationally specific and influence performance only on those dimensions to which the person is attending (i.e., conceptual). When cognitive strategies are activated (as with an expectancy manipulation), they work in conjunction with the more constant personality processes (e.g., achievement motivation) to facilitate performance.

This result is consistent with traditional conceptualizations of achievement motivation. Atkinson (1964) postulated that the tendency to achieve (T_s) is determined by three factors: (1) one's motive to succeed (M_s); (2) the probability of success (P_s); and (3) the incentive value of success ($I_s = 1 - P_s$). Thus $T_s = M_s \times P_s \times I_s$. Holdings levels of M_s constant, one's tendency to succeed will vary as the P_s (and consequently I_s) change. Optimal performance is obtained when $P_s = .5$. Less favorable performance occurs when P_s is more extreme (i.e., $P_s = .9$ or $.1$). Of more immediate interest to this report is the prediction that individuals with a lower level of achievement motivation (M_s), under optimal conditions, are hypothesized to perform at a level consistent with those of higher M_s levels under less optimal circumstances. This study directly examined this issue by including two P_s levels (.9 and .5). That those low to mid on achievement motivation receiving the low expectancy ($P_s = .5$) instructions performed equivalently to those mid to high on achievement motivation in the high-expectancy conditions ($P_s = .9$), respectively, adds further experimental confirmation to this theory.

However, there is an important divergence of these data from the theory. The above model posits an interactive relationship between expectancy and achievement motivation. The results of this study evidenced an additive effect. A possible explanation for this inconsistency rests with the manner in which expectancy is determined. Using the now classic ring-toss paradigm, Atkinson and Litwin (1960) allowed subjects to determine for themselves how far to stand from the peg. Individuals

⁴ In a previous pilot study (Piedmont, Gonyea, & Ozer, 1984), subjects received instructions that directed them to attend to either the factual or conceptual aspects of the passage. Another group was told to count the number of words, periods, and commas in the text. The results showed no significant effect for instructions in that regardless of directions, subjects tended to focus on the conceptual aspects of the task.

high in M_s preferred more intermediate distances than did low achievement-motivated subjects. Research has confirmed that the higher one's need for achievement, the greater one's preference for tasks of intermediate difficulty (Mahone, 1960; Morris, 1966; Veroff & Peele, 1969). Thus, under circumstances where subjects are free to select the task, expectancy of success may interact with levels of achievement motivation. However, in this study, the expectancy levels were imposed on the task by the experimenter. Under such circumstances expectancy may become more of a situational cue, triggering processes (both behavioral and cognitive) that work in conjunction with organismic dynamics. Therefore, in the former model expectancy serves as an internal dynamic which moderates the positive valence of achievement-related situations, while in the latter it acts as a cue that elicits particular adaptive behaviors. Further research is needed to clarify and explore these hypotheses. Nonetheless, it is clear that situational variables moderate the degree to which an individual is able to mobilize internal resources in a particular learning situation.

Another example of the interface between person and situation factors concerns the gender differences. As was shown in Fig. 1, there was an obvious difference in performance between males and females when a slow presentation rate was used, in that males performed better. With a fast presentation rate, males' performance decreased to that of females. It is interesting to note that regardless of differences in intrinsic motivational characteristics between males and females (e.g., achievement motivation, anxiety), situational properties of a particular learning environment can be manipulated to suppress such individual differences in performance due to gender. This is further evidence that situational variables strongly impact cognitive performance. However, further research is needed to more precisely delineate the contributions of such situational properties on task performance.

As noted earlier, Humphreys and Revelle (1984) developed a model of personality, motivation, and cognitive abilities that provides a structure for studying cognitive performance as a function of personal and situational factors. They posit two models that predict (1) that performance of high achievers will be the same as, or greater than, low achievers under varying amounts of arousal, or (2) high achievers will perform worse than low achievers under high levels of arousal. Our results appear to support and extend their first model. It appears that not only does increasing levels of achievement motivation facilitate performance, but increasing levels of arousal appear to facilitate this effect. However, such arousal appears to attenuate performance in low achievers.

Of particular interest is the manner in which anxiety affects performance for high and low achievers. Given the obtained pattern of correlation, increased arousal facilitates high achievers' ability to engage in more

complex cognitive tasks such as forming concepts and analogies concerning the presented material. For low achievers, such arousal more strongly impacts on their short-term memory ability; retaining factual information appears impaired. Not only does anxiety appear to have a differential effect on performance over varying levels of achievement motivation, but this arousal appears to affect different cognitive processes.

In conclusion, this study attempted to delineate the contributions of situational and personal factors that influence performance on a cognitive task. Both our review of the literature and the results of this study indicated the need to reconceptualize our understanding of motivation and its situational correlates. Our results reflect the usefulness of Humphreys and Revelle's general suggestion to examine such relationships in terms of their hypothetical constituent processes, as well as to illustrate the complex interactions that exist between personality variables, cognitive processes, and task characteristics.

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