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The results of this study seem to indicate that time may be a relevant variable when scores on a personality inventory are used to predict achievement of college freshmen. When a sample of freshmen college students were required to respond to statements of the California Psychological Inventory (CPI) in a controlled amount of time per statement, not only were four of the 18 scores significantly different from regular scores, but two of these scores, both individually and in combination, predicted achievement better than regular CPI scores. Introducing and controlling the dimension of time seems to make personality scores account for greater amounts of variance with an achievement criterion in the form of grade point average. If time is a relevant variable when scores of the CPI are used to predict achievement of college freshmen, it may well be a relevant variable when CPI scores are used for other purposes. The CPI is used extensively in counseling. It may be that constructs, reportedly measured by CPI scores, are altered when the dimension of time is introduced into their measurement. Construct validation of timed CPI scores should be carried out in order to determine if they are measuring the same characteristics as regular CPI scores. Suggestions for future research are given. (Author)

# TIME AS A RELEVANT VARIABLE WHEN PERSONALITY SCORES ARE USED TO PREDICT ACHIEVEMENT

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# Time As A Relevant Variable When Personality Scores Are Used to Predict Achievement

## Introduction

The prediction of academic achievement at the college level has been the subject of much research in recent years. The standard predictors are aptitude test scores and high school grades, often combined into a single index by a regression equation. The usual criterion for validation of these predictions is the college grade point average, usually for the freshman year.

The growing uniformity of selection techniques could lead one to assume that prediction of academic achievement at the college level has reached a fairly satisfactory state. Research indicates, however, that this is not the case. Fishman and Pasanella (1960) report that from a survey of studies done in the period from 1938 to 1958 the median correlation of cognitive measures and college grade point average was approximately .55. Lavin (1965) in his review of research in this area states that studies done from 1950 to 1961 indicate that measures of ability on the average account for 35 to 45 per cent of the variation in academic performance.

Thus from both surveys, it seems evident that while a single type of cognitive measure accounts for 30 to 45 per cent of the variation in academic achievement more than half still remains unexplained. It is not surprising, therefore, that some students who appear on the basis of test performance to have a high level of academic ability sometimes fail to meet the standards of their institutions, while in some cases less able students perform beyond their test-measured academic capacities. Some fault may lie with the tests themselves in that they do not provide a broad enough coverage of ability, but it could also be true that some proportion of the variability in academic achievement is influenced by factors other than those measured by past performance or aptitude tests. Attention has thus been given to personality or measures of noncognitive nature in the prediction of academic achievement.

Research indicates that personality measures in their present stage are poor predictors of achievement. The general findings (Barclay, 1965) indicate very little has been added to the prediction of academic success by the inclusion of noncognitive predictors. Fishman (1963) points out that the gain from including personality measures in the multiple correlation of cognitive predictors and achievement is usually less than .05 correlation points.

Lavin (1965) supports this lack of predictive power of personality measures, but his conclusions are not that noncognitive variables have no place in the prediction of achievement, but that the problem lies with how the variables are used:

> The current state of affairs may be more a reflection upon how personality variables have been used rather than upon their absolute usefulness. That is to say up to now almost all the studies reviewed conceive of the individual as if he were operating in a social vacuum. It might be, however, that personality characteristics are useful in predicting academic performance only when the social setting in which that performance takes place is conceptualized and used as a signficant variable. (p. 111)

There may be a real and active part of any social setting which, in the area of academic performance seems controlled to some extent in the criterion but not in the noncognitive predictors. This is the dimension of time. A student's grade in any given course may be largely dependent on a timed situation, i.e. the examination period. It is during such periods that the student must perform in a specified amount of time. No assumption is warranted that the total grade received is governed solely through performance in a specific time controlled period as courses often require outside work. Even with this outside work in courses on the undergraduate level, it does seem warranted, despite the lack of empirical evidence, to accept the assumption that some proportion of a student's grade in any course is governed by performance in a time controlled situation. The acceptance of this assumption constitutes one of the bases for this study.

## Statement of the Problem

If one of the purposes of personality scores is to predict achievement, then an administration of the personality inventory where the time allowed for response is controlled might result in scores which predict achievement better than scores obtained from regular inventory administrations. Could some of the unexplained variance between achievement and personality scores be related to the fact that the criterion measure is obtained through performance in a time controlled situation whereas the personality predictors are not? Past research offers no answers to this question.

By performance on personality inventories, we mean that a person must respond in some manner, usually by marking "true" or "false" to a series of statements. There is no control over the amount of time allowed for each response in the regular or booklet personality administration as each person is reading statements and responding to them at his own rate. In order to control the amount of time allowed for response, it is necessary to control in some manner the statement presentation time. Why then could not an auditory administration be utilized where all testees hear each statement at the same time? If this is done then statement presentation and time allowed for response could be controlled.

Accepting the assumption that time is present and real in the criterion of achievement at the college undergraduate level, this study seeks to investigate the effects of controlling this dimension in the measurement of personality predictors by obtaining them through a timed administration of a selected personality inventory.

## Research Hypotheses

1. A times administration of a selected personality inventory on college freshmen will result in scores which are different from scores obtained under regular administration.

2. A timed administration of a selected personality inventory will result in scores which predict achievement of college freshmen better than scores obtained under regular administration.

## Assumptions Underlying the Hypotheses

1. The achievement of college freshmen as shown by the first semester

grade point average is obtained to some degree through performance in a controlled time situation.

2. The regular administration of a personality inventory does not involve performance in a controlled time situation.

## Definition of Terms

1. Regular Administration. This is the usual method of personality inventory administration. The testee is given a booklet containing items or statements and an answer sheet. He responds to the statements by marking his answer sheet according to instructions given on the front of the booklet.

2. Timed Administration. The administration here is similar to the regular administration in that the testee responds on his answer sheet, but instead of reading the items from a booklet, he hears them through headsets which are connected to a tape recorder. The instructions are identical to those read by persons taking the inventory under regular administration, except for alterations of words which indicate the manner of item presentation. The dimension of time is introduced by having a constant time increment in which the testee responds to the items heard. The time increment is from the end of one statement to the beginning of the next.

A dearth of research is present on personality inventories and the effect of auditory versus booklet administrations. The only evidence found concerns the Minnesota Multiphasic Inventory (MMPI) and the CPI. The results (Urmer et al, 1960; Wolf and Shaffer, 1964; and Bennett and Rudoff, 1957) indicates that no appreciable difference in scores results from these two presentation methods. No evidence is given as to the predictive or construed validity of auditory versus booklet personality inventory administrations.

3. Achievement. In this study, the criterion of achievement is described as the first semester grade point average (GPA) of Fall 1966 Freshmen at the University of Maryland. This measure is obtained by a quality point formula where (A=4, B=3, C=2, D=1, F=0) grades are multiplied by credits per course and divided by total credits carried.

4. Selected Personality Inventory. The instrument used in this study is the California Psychological Intentory (CPI, Gough, 1957). The CPI is an inventory designed for use with "normal" or non-psychiatrically disturbed subjects. The 18 scales derived from responses to 460 items[1] are geared primarily to personality characteristics important for social living and social interaction.

Research on the CPI as a predictor of academic achievement (Gough, 1957; Holland, 1959; Maxwell, 1960; Jackson and Pacine, 1961; Johnson and Frandsen, 1962; Millar, 1963; Wessell and Flaherty, 1964; Giblette and Magoon, 1964; Bott and Giblette, 1965) indicate that while all of the 18 scores of the CPI

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[1] The CPI contains 480 items or statements to which the subject responds true or false as they apply to him. The last 20 items are not scored on any existing scale and thus are not included in the test administration.

have been shown to be related to achievement at some level, no one score or class of scores shows consistent efficiency for all groups of subjects.

## METHODOLOGY

### Design

The use of an equivalent groups design was incorporated in this study in order to test the hypotheses presented. Randomly selected University of Maryland freshmen were assigned to one of two groups. A times administration of the CPI was presented to one group (Experimental) and a regular administration to the other (Control).

The research hypotheses of this study were transformed into the null from as follows:

1. A timed administration of the CPI on freshmen college students will result in scores which are no different from scores obtained under regular administration.

2. A timed administration of the CPI will result in scores which do not predict achievement of freshmen college students any differently from scores obtained under regular administrations.

### Sampling Procedures

Entering freshmen at the University of Maryland are given the opportunity of attending any one of 29 two-day orientation sessions held throughout the summer months preceding September registration. While participation in this program is voluntary, an analysis of the students attending showed them to be representative of the total entering class.

A part of each two-day session is devoted to the University Counseling Center where students are introduced to the services and facilities of the Center and administered a test battery. It was from these times that the students were in the Center that subjects were drawn for this study.

Each group, according to a standard schedule, reported to the Center at 10:45 a.m. on the first day and returned at 8:40 a.m. on the second day. It was on the second day cycle that subject selection was made. As they reported to the Center they were led to a large classroom and administered the CPI under regular administration.

1. Experimental Group. On selected days, a sample of thirty students were drawn from the total group as they entered the building and taken to the testing room of the Counseling Center. The choice of sample size was governed by the seating capacity of the testing room. Here they took the CPI under a timed administration. Four different days gave a total sample of 120 students.

2. Control Group. On each of the four days that experimental group selection was made, a random sample of 30 answer sheets were drawn from the answer sheets of the group taking the CPI under regular administration.

An additional four days' selection furnished data for cross validation purposes.

No attempt was made to differentiate among college of enrollment as previous research (Giblette, 1964) shows the CPI as unrelated to this classification variable.

## Test Administration Procedures

While a definition of regular and timed CPI administrations has been stated, further descriptions of actual techniques employed are given at this time.

1. Regular CPI Administration. As students attending freshmen orientation reported to the Counseling Center at 8:40 a.m. they were led to a large classroom and as they entered were instructed to pick up from a table at the entrance a pencil, an answer sheet, a CPI booklet, and a sheet of instructions. While a supervisor was present during the time the students were completing the CPI, very little in the way of verbal instructions was necessary as the students began work as soon as they had read the instruction sheet.

The schedule of activities planned for students attending FO was very full. As an example, the students were scheduled to be at another place on campus at 10:00 a.m. Thus, they had at a maximum one hour and fifteen minutes to complete the CPI. Because of the time factor involved, some limited announcements were made concerning the amount of time left in order to get the students to their next place on campus. The effects of these announcements has not been investigated.

The investigator did make a count of the length of time it took students to complete the CPI under regular administrations. It was found that on one selected day, out of 186 students, 36 or 19 per cent finished in 45 minutes or less, and only 63 or 34 per cent finished in one hour. Thirty students (16 per cent) failed to finish in one hour and fifteen minutes. A count was made on four other days and similar results were found.

2. Timed CPI Administration. As the students came into the Counseling Center on a given day, the first 30 students were led to the testing room of the Center instead of to the large classroom. These students were part of 15 to 20 smaller groups of students each led through the FO program by an undergraduate "sponsor." The same sponsors did not bring their groups at the same time each day and thus it was assumed that this method of selection did not bias the sampling in any way.

As the students were led into the testing room, they took from a table at the front of the door a pencil and an answer sheet. Before each seat in the testing room, on a table, were a pair of headsets. These headsets were connected through a series of five extension jackboxes to a tape recorder situated in the front of the testing room. Students were asked to take a seat and to put on a pair of headsets. When all were seated and headsets in place, the investigator turned on the take recorded.

In order to keep the two methods of CPI administrations as comparable as possible, thus enabling any differences found to be attributable to the timed administration, the students selected for the experimental groups were not given any reason for their testing session being in the testing room instead of in the large classroom. They were actually unaware that the remainder of the group was indeed in the large classroom taking the CPI under

regular administration. They found out only after the timed administration was complete and they were told by the investigator where to meet their sponsors for the next scheduled event.

## Recording of the CPI Items

The 460 statements of the CPI were recorded by the investigator on a standard 12 in. reel of magnetic tape.[2] Tape speed was set at 3 and 3/4 inches per minute. The tape recorder used both in recording and test administration was a Wollensak, model number T-1500.

The items were recorded in a clear normal voice at an average or "conversational" rate. There was no way of measuring this presentation rate, but they were read distinctly and not at a fast pace. Between the end of one statement and the beginning of the next, a time increment of two seconds was allowed for response by the testee. When the tape was initially completed, it was presented to ten graduate students in psychology at the University of Maryland who all responded that the items could be understood and that there was ample time to respond. They were not told the length of time between CPI statements beforehand but afterwards guessed it to be from three to five seconds.

The two seconds interval was arbitrarily chosen. The CPI manual states that the time required to complete the CPI should be within 45 minutes to one hour. Thus students finishing in 45 minutes are using approximately six seconds to read and respond to each of the 460 items. Such a measure is very inaccurate as each student's reading rate is unknown as is the time he is taking to respond. If as personality inventories stress, a person should give his first impression (stated in instruction to experimental and control groups) then a time increment of two seconds seems adequate as a length of time in which to respond.

The measurement or control over the two seconds increment was accomplished through the use of a television broadcast of a recent United States Gemini space launch. All such launchings are preceded by a "countdown" where the time left to actual launch is given on the television screen. Time is given in remaining hours, minutes and seconds left to launch. With the sound of the television set turned off, the statements of the CPI booklet were recorded and a time increment of two seconds was obtained by watching the ongoing time count on the television screen. All statements were preceded by their number.

The reading time required for the instructions was five minutes 30 seconds. Item presentation time was 41 minutes and 45 seconds, making the total CPI administration lasting 47 minutes and 15 seconds. Students taking the CPI under a timed administration starting at 8:40 a.m. were finished at 9:28 a.m. Only about 22 per cent of the students in the control groups finished the CPI in this same amount of time as observed on four different occasions. The comparison is presented to show that the amount of time required to complete the CPI under timed administration is always known whereas under regular administration there is no way of knowing just when a student

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[2]Reproduced by special permission from the California Psychological Intentory by Harrison G. Gough, 1956.

will complete the CPI or indeed if he will complete the inventory in a predetermined amount of time.

Answer sheets from the experimental groups were scored separately from the control groups, and special identification marks were used in the punched cards to identify experimental and control CPI scores.

## Statistical Techniques Employed

1. Initial Analysis. In order to insure that experimental and control groups showed no difference in aptitude and ability, a comparison was made between the mean HSR and ACT scores of the total freshman class and the respective means of these variables for the experimental and control groups. The large sample "t" test was used (Clark, Coladarci and Caffrey, 1965) and tested for significance at the .05 level of confidence. Variance homogeneity was not analyzed as research suggests that for large samples of equal size this assumption is not important and need not be computed. (Boneau, 1960; Clark, Coladarci and Coffrey, 1965)

The first hypothesis of no difference in CPI scores under timed and regular administrations was tested by comparing the mean CPI scores of experimental and control groups for significant differences. A t value at the .05 level of confidence was decided on as acceptable.

The second hypothesis was tested by comparing the zero order coefficients of correlation (r) between GPA and CPI scores of experimental and control groups which showed significant mean differences. The method of comparison was made through the use of Fisher's Z Statistic. (Garrett, 1959)

As research indicates that total scores of the CPI predict achievement better than male and female scores separately (Gough, 1964a; Gough and Fink, 1964; and Gough, 1964b), it was deemed necessary to maximize prediction for the CPI by combining experimental and control scores shown to be different into an optimum equation. Regression equations utilizing the control and experimental scores found to be different were computed.

The efficiency of the resulting R's was shown by $R^2$ of the Coefficient of Determination (Garrett, 1959). $R^2$ shows the proportion of variance in the criterion accounted for by the predictors in the equation.

These regression computations were carried out at the computing Center of the University of Pittsburgh utilizing the Regression Analysis Program from the University of Michigan Utility Program File.

While not a major purpose of this study, two additional regression equations and R's were computed using the same CPI scores as predictors but adding in HSR and ACT in order to determine the effect of timed CPI scores on the predictive validity of cognitive measures.

2. Cross Validation. In order to determine if the decisions made on the two hypotheses of this study were in fact due to the timed administration and not to chance, a similar analysis was made on the additional samples of control and experimental subjects. Mean scores and r's of these scores with GPA were analyzed in the same manner as the initial scores. Cross validation of the R's was accomplished by computing the predicted GPA's, using the

respective equations initially found, on subjects in the two cross validation groups. The resulting r's between predicted and actual GPA became the validation of the initial R's.

## ANALYSIS AND RESULTS

In February, 1967 the initial and cross validation data were matched for GPA from the Registrar's Master File. Of the 480 subjects (120 Control, 120 Experimental and equal size cross validation groups) used in this study, GPA's were found recorded for 442.

Complete data were available for 213 control subjects and 229 experimental subjects. In order for the cross validation groups to be as similar in size to the initial groups, the results presented in this chapter were based on the following randomly selected sample sizes:

| Initial Sample | Cross Validation Sample |
|---|---|
| N = 116 Control | N = 97 Control |
| N = 116 Experimental | N = 113 Experimental |

At the .05 level of confidence, no differences were found between the mean HSR and ACT scores of both groups and their respective population means. Control and Experimental groups were thus shown to be equivalent on these variables.

### CPI Scores Obtained Under Regular and Timed Administrations

TABLE I
A COMPARISON OF CPI SCORES OBTAINED
BY CONTROL AND EXPERIMENTAL
GROUPS (N=116 EACH GROUP)

| | Control | | Experimental | |
|---|---|---|---|---|
| Scale | Mean | S. D. | Mean | S. D. |
| Do | 27.08 | 5.95 | 27.49 | 5.77 |
| Cs | 18.47 | 4.03 | 18.19 | 3.62 |
| Sy | 25.00 | 5.16 | 24.82 | 4.64 |
| Sp | 34.97 | 6.01 | 33.85 | 6.09 |
| Sa | 21.78 | 4.11 | 22.46 | 4.03 |
| Wb | 31.68 | 6.21 | 33.39 | 6.69 |
| Ri | 29.29 | 4.34 | 29.90 | 4.82 |
| So | 36.67 | 5.55 | 36.41 | 5.96 |
| Sc | 24.04 | 8.01 | 23.38 | 7.94 |
| To | 20.27 | 4.57 | 19.39 | 5.38 |
| Gi | 15.08 | 6.10 | 14.73 | 5.39 |
| Cm | 23.66 | 4.52 | 24.76* | 3.40 |
| Ac | 25.13 | 4.82 | 24.43 | 4.36 |
| Ai | 17.82 | 4.05 | 17.08 | 4.67 |
| Ie | 35.07 | 5.04 | 35.61 | 5.71 |
| Py | 10.65 | 2.51 | 9.96* | 2.61 |
| Fx | 11.27 | 3.73 | 9.38* | 4.50 |
| Fe | 20.34 | 5.30 | 18.94* | 4.50 |

*Means showed significant difference at .05 level of confidence or less

Three CPI scores, Py, Fx, and Fe showed a significantly lower mean score under timed administrations while one score, Cm, was raised. The first null hypothesis of this study, which is that a timed administration of the CPI will result in scores which are not significantly different from scores obtained under regular administrations, was rejected and the first research hypothesis accepted.

Correlations With GPA of CPI Scores Obtained Under Regular and Timed Administrations

TABLE II
ZERO ORDER COEFFICIENTS OF CORRELATION (r) BETWEEN CONTROL AND EXPERIMENTAL PREDICTORS AND GPA
(N=116 EACH GROUP, DECIMALS OMITTED)

| Score | Control | Experimental |
|---|---|---|
| Do | 05 | -03 |
| Cs | 14 | 12 |
| Sy | -03 | -08 |
| Sp | -11 | -04 |
| Sa | -03 | -08 |
| Wb | -13 | -03 |
| Re | 16 | 03 |
| So | 06 | -10 |
| Sc | -04 | -06 |
| To | -04 | 12 |
| Gi | -05 | -11 |
| Cm | 18* | -01 |
| Ac | 16 | -06 |
| Ai | 06 | 23* |
| Ie | 05 | 07 |
| Py | 01 | 29* |
| Fx | 04 | 37* |
| Fe | 19* | 18* |
| HSR | 47* | 37* |
| ACT | 37* | 38* |

*Significant at .05 level of confidence or less

The results shown here support the rejection of the second null hypothesis of this study, which is that a timed administration of the CPI results in scores which do not predict achievement any differently from scores obtained under regular administrations. Two scores under experimental administrations, Py and Fx, predicted GPA significantly better than corresponding control scores. The control CPI scores of Cm and Fe were the only ones found to have a significant correlation with GPA. The Experimental scores of Ai, Py, Fx, and Fe showed significant correlations with GPA. The Ai score while itself significant under timed administrations was not significantly different from the Ai score from regular administrations at the .05 level of confidence.

As expected, all cognitive measures showed significant correlations with GPA.

Multiple Regression Analysis of Regular and Timed CPI Scores

Further support for the decision to reject the second null hypothesis and accept the second research hypothesis came from Table III which shows the resulting multiple regression equations and R's generated from combining the four CPI scores shown to be different under Regular and Timed Administrations.

TABLE III
REGRESSION EQUATIONS, R AND $R^2$ FOR PREDICTING GPA
UTILIZING CPI SCORES FOUND TO BE DIFFERENT
FOR CONTROL AND EXPERIMENTAL GROUPS

| Group | N | Equation | R | $R^2$ |
|---|---|---|---|---|
| Control | 116 | X = .0269Fe + .0052 Cm + .0157 | .20* | .04 |
| Experimental | 116 | X = .0698Fx + .0389 Fe + .7079 | .43** | .18 |

*Significant at .05 level of confidence
**Significant at .01 level of confidence

Both the control and experimental R's were significantly different from zero. The Coefficient of Determination ($R^2$) for the control equation was .04 indicating that the variables Fe and Cm accounted for only 4 per cent of the variation in GPA, while $R^2$ of the experimental equation utilizing Fx and Fe accounted for 18 per cent of the variation in the criterion. Thus, not only does the timed administration of the CPI yield scores which individually predicted achievement better than regular scores, but the combining of scores into an optimum equation resulted in better prediction of achievement by the timed CPI scores.

It should be noted that the equation for the control group contained only the Fe and Cm scores, Py and Fx adding insignificant amounts of variance. The experimental equation utilizing Fx and Fe was not significantly improved by including the Cm and Py scores. As a cross check on the regression coefficients finally used in the two equations, regression equations were recomputed specifying a very low F level in order to include all four of the variables found to be different under timed administrations.

The resulting R using predictors of Cm, Py, Fx, and Fe for the control group was .21, an insignificant increase of .01 over the initial equation using Fe and Cm. The resulting R for the experimental group using all four CPI scores was .44, again an insignificant increase over the R of .43 obtained initially using Fx and Fe.

Multiple Regression Analysis of Regular and Timed CPI Scores Adding In Cognitive Predictors

The addition of the cognitive predictors to the respective equations is shown in Table IV.

TABLE IV
REGRESSION EQUATIONS, R AND $R^2$ FOR PREDICTING
GPA UTILIZING CPI SCORES PLUS HSR AND ACT

| Group | N | Equation | R | $R^2$ |
|---|---|---|---|---|
| Control | 116 | X=.0144HSR+.0293ACT+.0269Fe-.6059 | .54*** | .29 |
| Experimental | 116 | X=.0070HSR+.0567ACT+.0239Fe+.0568Fx-.7917 | .57*** | .32 |

***Significant beyond .001 level of confidence

The control R of .54 accounted for 29 per cent of the variation between predictors and criterion while the experimental R accounted for 32 per cent. Actually the increase in R of from .54 to .57 is somewhat misleading. The cognitive predictors of HSR and ACT for the control group yielded an R of .51 and the addition of Fe increased it to .54. The cognitive predictors for the experimental group showed an R of .46 with the criterion, Fx and Fe increasing it to .57. The control R was increased .03 correlations points while the experimental R was increased .11 points. Looking at $R^2$, the amount of variance accounted for was as follows:

1. The R for the cognitive predictors of the control group accounted for 26 per cent of the variation in GPA and Fe increased it to 29 per cent.

2. The R for the cognitive predictors of the experimental group accounted for 21 per cent of the variation in GPA with Fx and Fe increasing it to 32 per cent.

Timed CPI scores did account for greater amounts of variance in the criterion but it remained for cross validation to substantiate this apparent ability of Timed CPI scores. As with the initial groups, the cross validation control and experimental groups were representative in ability and aptitude as measured by HSR and ACT.

1. Regular and Timed CPI Scores

The same four CPI scores found in the initial groups to be significantly different under timed administrations were again shown to be different when cross validated on a similar sample. Cm was increased; Py, Fx, and Fe were lowered as seen in Table V.

TABLE V

A COMPARISON OF CROSS VALIDATED CONTROL AND EXPERIMENTAL CPI SCORES

| | Control (N=94) | | Experimental (N=113) | |
|---|---|---|---|---|
| | Mean | S. D. | Mean | S. D. |
| Do | 26.84 | 6.09 | 27.81 | 6.08 |
| Cs | 18.42 | 3.89 | 17.88 | 3.84 |
| Sy | 24.03 | 4.90 | 25.89 | 4.97 |
| Sp | 34.29 | 5.59 | 33.84 | 6.04 |
| Sa | 21.23 | 3.86 | 22.58 | 4.01 |
| Wb | 31.95 | 6.78 | 32.89 | 7.08 |
| Ri | 30.02 | 4.55 | 30.10 | 5.02 |
| So | 36.10 | 6.04 | 37.20 | 5.61 |
| Sc | 25.29 | 7.56 | 24.66 | 7.36 |
| To | 20.95 | 5.32 | 19.58 | 5.66 |
| Gi | 15.72 | 6.06 | 15.73 | 6.34 |
| Cm | 23.15 | 5.27 | 24.50* | 3.69 |
| Ac | 25.07 | 5.08 | 26.17 | 4.76 |
| Ai | 17.35 | 4.35 | 16.52 | 4.05 |
| Ie | 35.42 | 5.77 | 35.52 | 5.72 |
| Py | 10.49 | 3.01 | 9.45* | 2.96 |
| Fx | 10.63 | 3.56 | 8.63* | 3.79 |
| Fe | 20.51 | 4.87 | 18.72* | 4.58 |

*Means differ significantly at .05 level of confidence or less

2. Correlations with GPA of Regular and Timed CPI Scores

Results here are similar to the initial findings. Ai, Py, Fx, and Fe were again shown to be significantly correlated with GPA. The regular administrations upheld Fe as a significant predictor. Cm was not substantiated in cross validation. Re was significant in cross validation but not in the initial regular group. Cross validation upheld the difference between r's of Py and Fx for regular and timed administrations.

TABLE VI
CROSS VALIDATED r's OF CONTROL AND
EXPERIMENTAL GROUP PREDICTORS
WITH GPA (DECIMALS OMITTED)

| | Control (N=94) | Experimental (N=113) |
|---|---|---|
| Do | 06 | 10 |
| Cs | 09 | 07 |
| Sy | 01 | -09 |
| Sp | 03 | -09 |
| Sa | 16 | 04 |
| Wb | -04 | 09 |
| Re | 22* | 14 |
| So | 09 | 13 |
| Sc | 01 | 09 |
| To | 18 | 08 |
| Gi | -09 | 01 |
| Cm | 13 | 03 |
| Ac | 16 | 17 |
| Ai | 17 | 22* |
| Ie | 16 | 15 |
| Py | 03 | 31* |
| Fx | 08 | 38* |
| Fe | 21* | 18* |
| HSR | 36* | 37* |
| ACT | 51* | 36* |

*Significant at .05 level of confidence or less

3. Efficiency of Equations for Control and Experimental Groups Using CPI Scores

The two equations generated for the initial control and experimental groups using CPI scores were used to calculate the predicted GPA for each student in the respective cross validation samples. The predicted GPA's were then correlated with actual GPA's obtained by each student in order to determine the efficiency of the equations.

The validity of the equation for the control group dropped from .20 to .18 when it was applied to a similar cross validation group. The experimental equation shrunk from .43 to .42.

TABLE VII
EFFICIENCY OF THE CPI EQUATIONS WHEN
APPLIED TO CROSS VALIDATION GROUPS

| Group | N | r With GPA | R of Original Equation |
|---|---|---|---|
| Control | 94 | .18 | .20 |
| Experimental | 113 | .42 | .43 |

4. Efficiency of Equations for Control and Experimental Groups Using CPI Scores and Cognitive Predictors

Table VIII shows how the equations found by adding in cognitive predictors performed on similar cross validation samples.

TABLE VIII
EFFICIENCY OF THE EQUATIONS UTILIZING
HRS, ACT, AND CPI WHEN APPLIED TO
CROSS VALIDATION GROUPS

| Group | N | r With GPA | R of Original Equation |
|---|---|---|---|
| Control | 94 | .53 | .54 |
| Experimental | 113 | .49 | .57 |

The control R shrunk from .54 to .53. The experimental R dropped from .57 to .49. While the experimental equation R shrunk more than the control R, it was questioned as to whether or not the relationship found to be present in the initial groups concerning the amount of variance that the CPI predictors added to the cognitive predictors was essentially the same. This was answered by recomputing the predicted GPA's of the cross validation samples using only the respective control and experimental equations containing HSR and ACT scores. The r between predicted and actual grades for the control group using only these cognitive predictors was .50. The r between predicted and actual grades for the experimental group using these predictors was .42. The increase in the amount of variance accounted for in the criterion rose from 25 per cent (using HSR and ACT) to 28 per cent (adding in Fe and Cm) for the control group. The experimental equation showed HSR and ACT accounting for 18 per cent of the variation in the criterion, Fx and Fe increasing it to 24 per cent. Although the increase was not as large as that found with the initial groups, cross validation did show that experimental CPI scores added greater amounts of variance to the criterion than did control scores.

## Conclusions

The results of this study seem to indicate that time may well be a relevant variable when scores on a personality inventory are used to predict achievement of college freshmen. When a sample of freshmen college students at the University of Maryland were required to respond to statements of the CPI in a controlled amount of time per statement, not only were four of the eighteen scores significantly different from regular scores but two of these scores both individually and in combination predicated achievement better than regular CPI scores.

Introducing and controlling the dimension of time does seem to make personality scores account for greater amounts of variance with an achievement criterion in the form of GPA.

While the addition of cognitive measures of HSR and ACT to the CPI predictors resulted in multiple R's which were essentially the same

(.54 and .57) in the amount of variance accounted for, the T CPI predictors increased the cognitive predictor R by .11 correlation points whereas the S CPI predictors increased the cognitive predictors by only .03 points. It seems then, that T CPI scores as shown by initial and cross validation groups, did increase the predictability of cognitive measures better than S CPI scores even though the resulting R's are essentially the same. Only replication on much larger samples yielding closer cognitive R's between S and T groups will verify this apparent ability of T CPI scores.

A factor entering not only into the results found with cognitive plus CPI predictors but with CPI predictors alone, is the criterion used in this study. Its global nature may well be confounding the results. This study used the first semester GPA of freshmen college students as its criterion measure and while an attempt was made through the use of the ACT score to compensate for different levels of courses, no breakdown of colleges was made. While research does indicate that regular CPI scores are not related to this classification variable, could it be that GPA is obtained in a timed situation more so in some curricula than others? An analysis of T CPI scores earned by students in different curricula would clarify this question.

## Implications

If, as this study has shown, time is a relevant variable when scores of the CPI are used to predict achievement of college freshmen, then it may well be a relevant variable when CPI scores are used for other purposes.

This study attempted validation on only an achievement criterion. One of the purposes of the CPI is to predict achievement but it is also used extensively in counseling. The question of sex differences was not incorporated in this study. It may well be that constructs, reportedly measured by regular CPI scores, are altered when the dimension of time is introduced into their measurement. This study cannot support an interpretation of T CPI scores through reliance on the descriptions of these scores as given in the manual. There is no basis, for example, in describing a high Cm score under a timed administration as being "dependable, moderate, tactful ... and as having common sense and good judgment, " or a low Fx score as being "deliberate, cautious, worrying ... overly deferential to authority, custom, and tradition." These descriptions were based on validation of CPI scores from regular administration procedures. This study introduced a new dimension into the measurement of these traits and thus may be measuring something different. Construct validation of timed CPI scores should be carried out in order to determine if they are measuring the same characteristics as regular CPI scores.

## Suggestions for Future Research

Even though the hypotheses of this study were shown to be tenable, there are ramifications which were not investigated.

Time seems to be a relevant variable when CPI scores are used to predict achievement in the form of first semester GPA. Would similar or different degrees of relevancy arise if the criterion measure were obtained from separate colleges or curricula?

Why did only four CPI scores show significant differences under a timed

administration? Are only they affected by time? It may be that the measurement of properties of the scores are different, but not shown by comparing only mean scores. The intercorrelations of times CPI scores might be analyzed through factor analysis in order to answer this question.

Would construct validation of timed CPI scores result in the same or different descriptions of personality now described by regular CPI scores? Is time a relevant variable for separate male and female CPI scores in respect to the psychological constructs measured? And finally, is time a relevant variable in other personality inventories in respect to predictive, and/or construct validation?

It is difficult to identify any aspect of man's existence which is not affected by time. This study has investigated only one small aspect of behavior. The results and the questions they raise furnish a basis for basic research not only in respect to non-cognitive predictors of academic achievement but in respect to man's behavior in general.

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