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Project 7734, Task 17018

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Abstract

One criterion for airman skill upgrading in the Air Force is met by attaining a qualifying score on an applicable Airman Proficiency Test (APT). This note reports an analysis which shows the proportion of variance one such test has in common with selected measures of training, experience, education, aptitude, supervisory opinion, and airman attitudes for a sample of 384 aircraft mechanics tested in 1956 and 1957. Each of these categories of information, excepting airman attitudes, could be used to predict the APT criterion at some level of effectiveness; but only the training variables and the aptitude variables added significantly to the prediction attainable by using all other available information. Other research was cited in which various APT correlates are reported. Results show the utility of APT scores in defining one important aspect of airman proficiency.

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A Regression Analysis of One Set of Airman Proficiency Test Scores*

Airman Proficiency Tests (APTs) are paper-and-pencil examinations which measure what an airman knows about his specialty. The highly structured work situation in the Air Force, covered by detailed procedural publications which are completely authoritative, readily lends itself to the application of the principle of content validity in the construction of APTs and in the interpretation of results obtained through the use of these tests. One of the recurring observations regarding APTs, however, is suggested by the circumstance that the tests are written examinations which may not always indicate what knowledge an airman can or will bring to bear on the job. This note reports an analysis which shows the proportion of variance one such test (PRT 215, Aircraft Mechanic, 2nd Revision, 1 January 1955) has in common with certain other presumably relevant measures obtained on a sample of aircraft mechanics tested in 1956 and 1957. Other research is cited in which various APT correlates are reported. The area of investigation is a broadly important one because a qualifying score on an available Airman Proficiency Test satisfies the mandatory knowledge qualifications for skill upgrading in the Air Force (AF Manual 35-1).

Procedure

The analysis pertains to 384 mechanics upon whom complete information was obtained. These men were responsible for the maintenance and inspection of F-86D aircraft at 15 Air Defense Command bases. They had been on the job for 13 months, on the average, after having completed a general aircraft maintenance course at an Air Force technical school. In terms of Airman Classification Battery (ACB) Mechanical Aptitude Index (MAI) scores, they were a somewhat select group ($\overline{X} = 5.80$; $SD = 1.45$). In terms of ACB General Aptitude Index (GAI) scores ($\overline{X} = 4.99$; $SD = 1.76$), in terms of education, and in terms of other available information, there is no reason to believe that the sample departed from the Air Force population of individuals at the same military rank and of the same length of service. The reliability of the criterion variable used in this investigation (APT score), based upon the performance of the 384 mechanics, was .90 (Kuder-Richardson Formula 21).

An iterative technique for multiple regression, as outlined by Greenberger and Ward (1956), was used as the statistical procedure for treating the assembled data. The procedure allows the investigator to describe APT scores in terms of the variance they have in common with other kinds of data. In the present investigation, these data include, as separate categories, six groups of variables: training variables, experience variables, education variables, aptitude variables, supervisory rating variables, and certain attitude variables.

Results

The information contained in Table 1 was derived from material reported in Appendix A, which contains intercorrelations and distribution statistics for the basic data. Each variable

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listed in Appendix A is included in one and only one of the table categories. The body of the table contains two types of information:

a. Multiple R^2 values expressed as proportions of the variance in APT scores which can be grossly associated with each kind of measure listed (Note 1, Appendix B). The variance ratio, F, computed for these particular proportions, is given in the second column.

b. Multiple R^2 values expressed as proportions of the variance in APT scores which can be uniquely associated with each kind of measure listed, i.e., the proportions over and above that which may be associated with all the other kinds of measures considered (see Note 2, Appendix B). F values for these proportions are given in the fourth column.

The entries in the last column of Table 1 indicate the magnitude of the statistic F which must be attained before the reported proportions of criterion variance can be considered anything other than zero at the .01 level of confidence (see Note 3, Appendix B).

TABLE 1. Proportion of Variance in Proficiency Test Scores Held in Common with Certain Other Kinds of Measures

(Sample: 384 F-86D Mechanics, Air Defense Command)

	Total Proportion		Unique Proportion		
Kind of Measure	Proportion	F	Proportion	F	F_{01}
Training[1]	.363	108.6	.077	26.4	4.7
Experience[2]	.041	3.3	.015	2.1	3.1
Education[3]	.064	13.0	.007	2.4	4.7
Aptitudes[4]	.315	87.6	.055	18.9	4.7
Ratings[5]	.078	6.4	.010	1.4	3.1
Attitudes[6]	.027	1.3	.007	.6	2.6

[1] Technical school grades, Months on OJT.

[2] Months in Air Force, Months on job, Months in grade, Number of tasks presently done, Difficulty of tasks presently done.

[3] Years education, High School graduate (yes, no).

[4] Airman Classification Battery: Mechanical Aptitude Index, General Aptitude Index.

[5] Airman Performance Report: Knowledge rating, Performance rating, Overall rating, Promotion recommendation; Score on Performance Check List. All accomplished by examinee's supervisor.

[6] Eight attitude measures: Job, Air Force, Air Force career (three measures), OJT, Technical school, Reenlistment intent (yes, no).

The reader will note, then, that except for the category of "attitudes," each category of information named in Table 1, when used alone in a regression problem, can be used to predict the APT criterion with some degree of efficiency. All except one of the F values reported in

the second column are greater than the value indicated for F_{01}. On the other hand, only training information and aptitude information are seen to make significant unique contributions to the prediction of APT scores. Only two of the F values reported in the fourth column of Table 1, those for training and aptitudes, exceed the values given for F_{01}.

Discussion

With the data at hand, we are able to account for .473 of the variance in a set of APT scores when all variables together are given an opportunity to contribute to the prediction. As a proportion of the variance accounted for in a set of achievement test scores, this proportion is high. An even higher proportion of the variance probably could be explained with the use of better measures of the present predictors. Months on on-the-job training (OJT), for example, probably does not give a good indication concerning OJT accomplishments. Attitude measures are not always dependable. The reliability of rating data is often disappointing, especially when it is assembled under field conditions. As for the criterion measure (APT score), some doubt may be expressed concerning the utility or perhaps even the accuracy of information taken from records maintained at the base level. Some of the APT entries were retest scores and some were not. Since initial scores had presumably been eliminated whenever new record forms were completed only the most recent score could be recorded and used.

The reader should remember that only one APT has been considered in this investigation, and that statements concerning APTs in general, based only upon the results reported here, are not in order. In the discussion that follows, therefore, a special effort is made to reference other material which tends to support (or not support) the present findings.

Training

Technical school grades and number of months on on-the-job training (OJT) were the training variables examined. The gross proportion of variance of the APT criterion attributable to the linear combination of these two measures, .363, is quite high. The results of the study also indicate, however, that almost all the proportion just noted is attributable to school grades. The zero-order r between grades and APT scores equals .59, whereas the zero order r between months on OJT and the APT criterion was found to be only .05.

Appendix A gives the zero-order rs derived for the present analysis. In these and the following references the reader may prefer to visualize r^2 rather than the reported r values to maintain the "proportion of variance in common" context. Thus the .59 value becomes $(.59)^2$ or .35. The use of r, however, simplifies the reference to correspondences or differences between the present findings and results of earlier studies.

Brokaw (1959) reports a product-moment r of .60 (versus the present .59) between final school grade (FSG) and APT score for 1000 aircraft mechanics. The median r reported by Brokaw for 46 specialties was .55. Austin found a median r of .52 for APT-FSG relationships in a study involving 15 specialties, with Ns from 117 to 1007 (see Note 4, Appendix B). Judy (1959) reports a product-moment r of .10 (versus the present .05) between months on OJT and score on another type of written test of knowledge for 415 aircraft mechanics. Neither of these last r values is large enough to be statistically significant at the .01 level of confidence. It appears, then, that the correlations upon which the present analyses were based are in line with relationships previously noted.

Table 1 shows that .077 of the variance in the APT criterion can be uniquely associated with the training variables considered. This proportion is greater than the proportion of unique variance which can be associated with any other single kind of measure examined in the course of this investigation. The amount is highly significant in a statistical sense, and it indicates that training variables, over and above all other kinds of measures considered, can make a sizable contribution toward the prediction of an APT criterion.

Experience

The experience variables studied included months in the Air Force, months on the job, months in grade, and two measures which were meant to give an indirect indication of the experience level of each of the 384 men: number of tasks he does, and the difficulty of those tasks. The gross proportion of variance of the APT criterion attributable to the linear combination of these measures, .041, is quite low but still statistically significant at the .01 level of confidence. Only .015 of the criterion variance can be identified as unique variance associated with experience variables, however. This last proportion is not significantly greater than zero.

Other analyses, in which zero-order correlations between APT scores and measures of experience were obtained, agree with the findings of this investigation. In a study using reciprocating engine technicians, Maxwell found "very low positive or negative" relationships between APT scores and months of experience (see Note 5, Appendix B). In another study involving APTs in the Vehicle Maintenance career field, Maxwell found test performance not significantly different for groups having less than three months of experience and those with four to six months of experience (see Note 6, Appendix B). In still another study Maxwell assembled special information concerning the work experience of aircraft mechanics and aircraft maintenance technicians. It was found that test performance was not generally different for groups of mechanics with unlike experience (see Note 7, Appendix B). Madril, Buttram, & Hemingway, in a study involving senior aircraft mechanics, reported as non-significant the relationship between APT scores and recorded months of experience (see Note 8, Appendix B).

If the available information indicates a general trend, it would seem that APTs in the mechanical area measure very little of whatever a person gains by time on the job. Whether or not this is to be viewed as a satisfactory circumstance for any given specialty depends to a large extent upon whether or not there are critical job elements which can only be learned or demonstrated on the job. In the mechanical area, experience is necessarily gained on specific equipment and it is doubtful that a general examination (covering a whole specialty) should be expected to discriminate high- and low-experience groups. In some assignment situations or in some specialties in which airmen have a good chance to gain experience in several shreds of a specialty, the APT-experience relationships can be expected to be higher than those reported in this research.

Education

The education variables studied included years of education and a dichotomous variable on high-school graduation. The gross proportion of variance of the APT criterion attributable to the linear combination of these measures, .064, is low but statistically significant at the .01 level of confidence. Less than 1% (.007) of the criterion variance, a non-significant amount, can be identified as unique variance associated with education variables. Only one other category of variables examined in this investigation, the attitudes category, makes as little unique contribution to the prediction of the APT criterion.

The zero-order correlations found in the present study between APT scores and education variables (r = .22; r = .25) are somewhat larger than those found in other investigations. Chajet & Schwartz, in a study of the Supply and the Air Traffic Control and Warning career fields found the relationship between APT scores and years of education to be .10, −.02, and .18 for different groups of men (N = 139; N = 591; and N = 157; see Note 9, Appendix B). Judy (1959) reported *r*s of .16 and .18 for this kind of relationship for 415 aircraft mechanics when the Written Evaluation of Mechanics' Proficiency (WEMP) rather than APT scores were being analyzed. In a study involving 15 specialties (with *N*s from 117 to 1007), Austin found a median *r* of .13 for APT-education relationships (see Note 4, Appendix B).

The generally low relationships found between APT score and measures of formal education should be noted. Even in the present investigation in which these relationships were relatively large, a non-significant portion of the variance in APT scores is found uniquely associated with the education variables. Any other finding would perhaps indicate, especially for the mechanical area, that irrelevant academic factors were playing an important role in APT measurement.

Aptitudes

The aptitude variables included in this study were the Mechanical Aptitude Index (MAI) and the General Aptitude Index (GAI) from the Airman Classification Battery (ACB). The linear combination of these two measures accounted for .315 of the total variance in the APT criterion. As shown in Table 1, .055 of the criterion variance can be uniquely associated with these particular measures. Both of these proportions are large enough to be highly significant in a statistical sense.

The zero-order correlation showing relationships between APT score and aptitude were .56 for mechanical aptitude and .46 for the general aptitude measure (see Appendix A). The corresponding values reported by Brokaw (1959) for 1000 aircraft mechanics were .61 and .51. (Both of Brokaw's values were corrected for restriction in range brought about by selection for training.) For other specialties in the mechanical area the MAI-APT correlation reported by Brokaw ranged from .34 to .72. The GAI-APT relationships reported by him ranged from .31 to .66. Thomas reports product-moment correlations of .42, .40, .51, and .49 between APT score and MAI for four career fields in the mechanical area for which the MAI is the qualifying AI (*N*s were 518, 138, 102, and 102; see Note 10, Appendix B). He did not report GAI-APT relationships. "Corrected" APT-MAI *r*s ranging from .30 to .68 (with *N*s of 250 to 1007) were reported by Austin for six specialties in the mechanical area (see Note 4, Appendix B). It would appear, then, that the zero-order correlations upon which the present analyses were based are in close agreement with those previously noted.

In the present study, aptitude variables share with training variables the distinction of being measures which have a highly significant unique contribution to make to the prediction of the APT criterion. It is to be expected, of course, that measures which identify individuals capable of doing well in particular training programs will differentiate those same individuals, though imperfectly, in terms of the amount of useful information they have been able to acquire, as measured by an Airman Proficiency Test. Present knowledge about aptitudes does not allow one to specify the amount of overlap there should be between any one of them and any particular measure of "proficiency." The traditional concern about the verbal content of job knowledge tests, particularly those in the mechanical area, is perhaps justified, but even here there is some reason to believe that the ability to handle verbal material (especially in the Air Force maintenance situation) may be one valid aspect of proficiency.

In the opinion of the writer, the verbal level of current APTs is not so high that special consideration need be given this factor in interpreting APT-aptitude relationships. One facet of the general matter has been investigated by Polin who found a mean reading level (using the Forbes-Cottle Readability Formula) of "11th grade" for APTs for eight specialties in the Metal Working career field, and "11th grade" for APTs for four specialties in the Intelligence career field (see Note 11, Appendix B). Chajet, using the Flesch Formula with 24 APTs, found a mean reading level corresponding to the 12th grade. His syllabic count was equivalent to the second year of college, while the average sentence length corresponded to the eighth grade (see Note 12, Appendix B). These levels are not grossly above the reading levels of airman groups now in the Air Force. The mean education level of the subjects of the present study was 11.01 years.

Ratings

The rating variables examined included, for each airman, six-point supervisory ratings on: (1) How much does he know about his assigned duties? (2) How well does he do his assigned duties? and (3) What is your overall rating of this man? They included also (4) a three-point rating as to whether the supervisor recommended the airman for promotion, recommended him along with other airmen of equal service and experience, or recommended him ahead of other airmen of equal service and experience. These four ratings are reported on the Airman's Performance Report (APR), AF Form 75. The fifth measure (5) was a score on a performance check list completed by the airman's supervisor. The linear combination of all the above measures accounted for .078 of the total variance in the APT criterion. Only .01 of the criterion variance can be identified as unique variance associated with these rating variables, however. This last proportion is too small to be statistically significant.

The zero-order correlations between APT score and rating variables (ranging from .07 to .22 in the present study) are in line with other such relationships that have been reported. Limiting himself to an APR "Overall" rating, Thomas obtained Pearson *r*s ranging from −.03 to .31 in a study covering 16 specialties (see Note 10, Appendix B). Only three of the values were significant at the .01 level of confidence. Chajet & Schwartz (see Note 9, Appendix B) report a similar correlation of .09 for the Air Traffic Control and Warning career field; for the Supply career field, they report *r*s of .08 and .14. No one of the values reported by Chajet & Schwartz was large enough to be statistically significant at the .01 level of confidence.

On the basis of available information, it would seem that APTs and supervisory ratings, as obtained through the use of the APR, measure very little in common. To the extent that this is a valid observation it is not surprising that the occasional comment is made that "one of my good men cannot pass the APT." McQuitty, Wrigley & Gaier (1954) found that supervisors describe trained mechanics who are selected by them to vary in proficiency much more in terms of interest and motivation than in terms of the amount of job knowledge possessed. Some of the work of Humphreys & Schmid supports the notion that the best measure of the general proficiency factor is a consensus obtained from several *different* ways of measuring proficiency, specifically including the use of printed tests and supervisory ratings (Note 13, Appendix B). Both of the latter types of information (supervisory opinion and APT scores) are presently taken into account in Air Force upgrading operations (AF Manual 35-8). From a measurement point of view, it is good that two or more relatively independent aspects of proficiency can and are being used.

Attitudes

The attitude variables examined included measures on attitude toward assignment, Air Force, Air Force career (three measures), on-the-job training, technical school, and a dichotomous measure on reenlistment intent. The proportion of variance of the APT criterion grossly attributable to the linear combination of all these measures was .027. Only .007 of the APT variance was unique to these measures. Neither of these proportions is large enough to be statistically significant at the .01 level of confidence.

The zero order correlations between APT score and the different measures of attitude examined are all essentially zero. To the writer's knowledge, APT-attitude relationships have not been reported elsewhere. Schmid & Detter found non-significant relationships (Pearson *rs* of −.03 to .08 with an *N* of 238) between measures of attitude and score on another type of job knowledge test (see Note 14, Appendix B). Research summarized by Tupes & Yarnold (1952) shows, however, that it is not unreasonable to expect a higher relationship between criteria of Air Force success and measures obtained through the use of carefully constructed attitude scales.

Summary

In this report one set of Airman Proficiency Test (APT) scores is described in terms of the variance held in common with selected measures on training, experience, education, aptitude, supervisory opinion, and airman attitudes for 384 mechanics tested in 1956 and 1957 in the Air Defense Command. It was found that each of these categories of information, excepting airman attitudes, could be used to predict the APT criterion at some level of effectiveness. Only the training variables and the aptitude variables, however, were found to add significantly to the prediction attainable by using all other available information. Other research was cited in which various APT correlates are reported.

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Appendix A

Intercorrelations and Distribution Statistics for Variables Used in APT Analysis

(Sample: 384 Air Defense Command Mechanics)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Mean	SD
1	APT Scores	1.00	.59	.05	-.01	.10	.10	.02	.01	.22	.14	.07	.08	.14	.56	.46	-.06	-.12	-.08	.02	.03	.01	.02	-.04	.22	.25	96.39	17.44
2	Tech Sch Grades	.59	1.00	-.08	-.11	-.09	-.01	.00	-.05	.29	.23	.21	.17	.15	.61	.58	-.10	-.16	-.12	.05	.09	.06	.09	-.04	.34	.33	51.43	6.97
3	Mo. on OJT	.05	-.08	1.00	.20	.31	.28	-.08	-.03	.11	.08	.11	.01	-.07	-.07	-.11	.10	.03	.07	.02	.04	-.02	-.01	-.07	-.01	.00	.44	.64
4	Mo. in Air Force	-.01	-.11	.20	1.00	.83	.61	.15	.01	.02	-.05	-.10	-.01	.16	-.17	-.10	-.17	-.12	-.14	.10	-.06	.00	.07	.07	-.01	-.01	20.74	6.44
5	Mo. on Job	.10	-.09	.31	.83	1.00	.69	.12	.03	.08	.00	-.09	-.01	.17	-.09	-.10	-.16	-.11	-.14	.06	-.06	-.04	.03	.07	-.03	-.03	13.07	6.70
6	Mo. in Grade	.10	-.01	.28	.61	.69	1.00	.13	.03	.13	.12	.05	.04	.17	-.07	-.08	-.07	.03	-.12	.05	-.07	-.02	.06	-.04	.09	.06	5.79	5.55
7	No. of Tasks	.02	.00	-.08	.15	.12	.13	1.00	.14	.04	.05	.04	.05	.14	-.05	.04	.01	.03	.00	.05	.00	-.09	-.02	-.06	.06	.08	127.29	41.10
8	Difficulty of Tasks	.01	-.05	-.03	.01	.03	.03	.14	1.00	.06	.01	.06	.06	.06	-.06	-.06	-.04	.01	-.06	-.09	.01	.00	-.08	.01	-.07	-.07	.55	.50
9	APR Know	.22	.29	.11	.02	.08	.13	.04	.06	1.00	.72	.74	.55	.35	.16	.16	.05	.00	.00	-.04	-.02	.00	.01	-.15	.13	.13	3.62	.85
10	APR Do	.14	.23	.08	-.05	.00	.12	.05	.01	.72	1.00	.83	.61	.31	.12	.14	.14	.11	.05	.05	.00	.06	.01	-.19	.07	.10	4.01	.95
11	APR Overall	.07	.21	.11	-.10	-.09	.05	.04	.06	.74	.83	1.00	.60	.25	.09	.07	.14	.13	.06	.02	.04	.06	.04	-.18	.08	.10	3.99	.89
12	APR Promotion Rec	.08	.17	.01	-.01	-.01	.04	.05	.06	.55	.61	.60	1.00	.31	.08	.06	.06	.10	.00	.00	.00	.09	.05	-.15	.07	.11	2.20	.50
13	Performance List	.14	.15	-.07	.16	.17	.17	.14	.06	.35	.31	.25	.31	1.00	.05	.06	.00	-.01	.01	.06	-.04	.05	.04	-.07	.09	.09	344.66	50.62
14	ACB Mech AI	.56	.61	-.07	-.17	-.09	-.07	-.05	-.06	.16	.12	.09	.08	.05	1.00	.73	-.07	-.13	-.08	-.10	.07	.04	.07	.05	.37	.36	5.80	1.45
15	ACB Gen AI	.46	.58	-.11	-.10	-.10	-.08	.04	-.06	.16	.14	.07	.06	.06	.73	1.00	-.11	-.16	-.12	-.10	.09	.04	.02	.02	.41	.37	4.99	1.76
16	AF Attitude	-.06	-.10	.10	-.17	-.16	-.07	.01	-.04	.05	.14	.14	.06	.00	-.07	-.11	1.00	.60	.38	.20	.03	.09	-.07	-.38	-.11	-.10	59.54	6.98
17	Job Attitude	-.12	-.16	.03	-.12	-.11	.03	.03	.01	.00	.11	.13	.10	-.01	-.13	-.16	.60	1.00	.33	.20	.06	.09	-.03	-.32	-.09	-.07	51.10	5.41
18	OJT Attitude	-.08	-.12	.07	-.14	-.14	-.12	.00	-.06	.00	.05	.06	.00	.01	-.08	-.12	.38	.33	1.00	.11	-.06	.00	.01	-.17	-.09	-.09	18.47	2.94
19	Tech Sch Attitude	.02	.05	.02	.10	.06	.05	.05	-.09	-.04	.05	.02	.00	.06	-.10	-.10	.20	.20	.11	1.00	.04	.02	.14	-.06	-.06	-.09	11.72	1.85
20	Career Attitude A	.03	.09	.04	-.06	-.06	-.07	.00	.01	-.02	.00	.04	.00	-.04	.07	.09	.03	.06	-.06	.04	1.00	.47	.25	.00	.12	.09	22.66	20.10
21	Career Attitude B	.01	.06	-.02	.00	-.04	-.02	-.09	.00	.00	.06	.06	.09	.05	.04	.04	.09	.09	.00	.02	.47	1.00	.24	-.21	.06	.06	28.00	20.60
22	Career Attitude C	.02	.09	-.01	.07	.03	.06	-.02	-.08	.01	.01	.04	.05	.04	.07	.02	-.07	-.03	.01	.14	.25	.24	1.00	.02	.07	.09	29.48	12.96
23	Reenlistment Int	.04	.04	.07	-.07	-.07	.04	.06	-.01	.15	.19	.18	.15	.07	-.05	-.02	.38	.32	.17	.06	.00	.21	-.02	1.00	.03	.00	3.34	1.21
24	Years Education	.22	.34	-.01	-.01	-.03	.09	.06	-.07	.13	.07	.08	.07	.09	.37	.41	-.11	-.09	-.09	-.06	.12	.06	.07	.03	1.00	.86	11.01	1.45
25	H S Grad	.25	.33	.00	-.01	-.03	.06	.08	-.07	.13	.10	.10	.11	.09	.36	.37	-.10	-.07	-.09	-.09	.09	.06	.09	.00	.86	1.00	.58	.49

Appendix B
Notes

1. In arriving at the Total Proportion, squared multiple-correlation coefficients were obtained, using only one kind or category of variables at a time in the separate regression equations. These values were taken as estimations of the proportion of criterion variance for which we would be able to account were we limited to only one kind of information about the subjects.

2. In arriving at the Unique Proportion, a squared multiple-correlation coefficient was computed giving all variables studied a chance to contribute to the magnitude of the coefficient. This coefficient was then recomputed, omitting, in turn, each kind of variable represented on the total list. Difference in the obtained values (using all variables versus all except one kind) was taken as an estimation of the proportion of variation in the criterion measure which each type of predictor can add to the proportion attributable to all the others. This difference is referred to in this report as the *unique contribution* to distinguish it from the total or *gross contribution* obtained when considering the role of each kind of variable without reference to the others.

3. The exact value for F_{01} is slightly different for testing the significance of the two Fs reported in each line of Table 1, but these differences occur in the second and third decimal places and do not materially affect the magnitude of the one-decimal-place values given in the table under F_{01}. In the computation of F in each instance, the degrees of freedom for the number of predictors was determined by the number of predictors given a chance to contribute to the prediction. This leads to a more conservative test than one in which the degrees of freedom for the number of predictors is defined by the number of predictors actually functioning in the build-up of multiple R^2 before the iterative process is terminated.

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