SELF-DETERMINATION AND SELF-MOTIVATION IN RELATION TO PERFORMANCE: A STUDY OF INTERACTION EFFECTS

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The Problem

A decade ago Katz, Maccoby, and Morse (4) observed in a clerical organization that supervisors of high producing groups more often used "general" than "close" supervision, in comparison with low producing groups.

The use of general supervision by the superior implies exercise of greater autonomy by the subordinate—that is, relatively high freedom to make decisions (within specified limits) concerning goals or methods of one's job. Other terms similar in connotation are "delegation of authority, freedom, independence." A second and closely related concept is that of control—the ability to influence decisions (or decision-makers) concerning the limits within which one works. The term "participation in decision making" has a similar meaning, as does "influence on superiors."

In field studies, measures of these two concepts tend to be associated. Both can be viewed as aspects of a broader concept of self-determination, meaning both the ability to determine what one does within specified limits (autonomy) and the ability to share in determining the limits (control).

Often such measures have a mild positive relationship with productivity, as in the early Katz study. But the findings are not always consistent. In a sequel, Katz and associates (5) studied railroad track maintenance crews and found no relationship between crew productivity and closeness of supervision.

Subsequently, Morse and Reimer (8) undertook a large-scale field experiment to test the effects of deliberately raising the locus of control (hierarchical program) versus lowering it (autonomous program). The experimental treatment affected both aspects of self-determination. Morale and motivation were found to fall under the hierarchical program and to rise under the autonomous treatment. But—contrary to expectation—productivity under both conditions increased.

Results such as these prompt a search for additional conditions, whose presence or strength makes a difference in whether the expected effect of self-determination on performance will appear. Some of the conditions detected to date are the following.

Amount of contact with superiors. In a medical research organization, Pelz (11) observed that younger scientists were more productive when given independence in choice of work objectives—provided they maintained daily contact with their chief. Without close contact, independence was unrelated to performance.
Personality needs. Vroom (17) observed that supervisors' feeling of participation in decision-making had different results, depending on scores of authoritarian personality and need for independence. Among equalitarians and those desiring independence, participation in decision-making was positively related to attitudes and performance. Among authoritarians and those with low independence needs, no relationships appeared. In an analysis from the Morse and Reimer experiment, Tannenbaum and Allport (16) demonstrated that the decentralized or autonomous program was better liked by persons with a need for independence, while the centralized or hierarchical program tended to be better liked by submissive persons.

Social norms. French, Israel, and As (3) repeated in a Norwegian footwear factory an experiment similar to that of Coch and French (2) in an American clothing factory, using employee participation in decisions on technological changes. Data from the later study supported the hypotheses that (a) the effects of participation hold only for subjects who experience an amount of participation they consider legitimate, and (b) the effects increase with decreasing resistance to the participation methods.

Work group structure. In a study by Vroom and Mann (18) of a parcel delivery company, the independent variable was supervisor's F-score or authoritarian tendency, rather than actual closeness of supervision. Dependent variable was employees' satisfaction toward the supervisor, rather than productivity. The authors separated day crews (drivers) from night crews (positioners). Day crew drivers worked separately; night crews worked cooperatively. By day, supervisor's F-score correlated +.41 with employee satisfaction; by night, -.41.

For continued theoretical progress it is essential to continue probing the context in which self-determination occurs. In this search it is crucial to recognize the complexity of relationships involved, and to utilize analysis techniques which reveal rather than hide them. The phenomena that we are exploring are technically "interaction effects." The term "interaction," unfortunately, is also used for completely different phenomena. Because of frequent confusion, the concept is reviewed briefly before presentation of data.

Interaction Effects

Given two or more predictors (independent variables) A, B, ... and a criterion (dependent variable) Y, then "A × B interaction with respect to Y" is said to exist if the relationship of A to Y varies, depending on the level of B; or if the relationship of B to Y varies, depending on the level of A. The studies cited above illustrate different ways in which interaction effects may appear.

Terms in the literature. Interaction phenomena and related concepts in social-psychological data have been indicated by various terms. A decade ago Morris and Seeman (7) noted that effects of a given leadership style might vary depending on the context. Leadership style or personality they called "determiners," group size and other contextual factors they called "conditioners."
Pelz (10) found that when supervisors possessed influence or power with higher-ups, positive correlations appeared between supervisor's supportiveness and employee satisfaction; when supervisors lacked influence, correlations were predominately zero or negative. Following Morris and Seeman, the supervisor's influence was termed a conditioner of the relation between supportiveness and satisfaction, and "conditioning effect" was suggested for the interaction phenomenon.

In a discussion of the logic of three-variable analysis, Kendall and Lazarsfeld called the interaction phenomenon "specification" (Merton and Lazarsfeld, 6, pp. 147-167).

Saunders (12), in prediction of grades from vocational interest scores, showed how the correlation between various predictors and the criterion could vary, depending on the level of a "moderator" variable. He gave the algebra for a "moderated multiple regression," differing from the usual multiple regression in the inclusion of a term for the interaction effect.

Recently Blau (1) used the term "contingency effect" for the same phenomenon.

Comments. A common misconception is that interaction depends on, or is somehow influenced by, the presence of correlation between A and B. So long as there exist cases in which A varies within successive levels of B (or vice versa), interaction effects of any magnitude can appear, regardless of whether A and B are correlated.

A related confusion is that of conditioning variable with intervening variable. If A affects B, and B in turn affects Y, then B is said to intervene between A and Y. Demonstration of an intervening effect requires the existence of both AB correlation and BY correlation. But interaction or conditioning effects can occur whether or not there is any AB correlation. (In the Kendall and Lazarsfeld discussion, 6, pp 154-158, intervening variables are involved in the M or "marginal" type of elaboration, especially what they call "interpretation", whereas interaction appears in the P or "partial" type which they call "specification.")

Conceptually, determiners and conditioners both have the status of independent variables or predictors. Among many predictors it is sometimes arbitrary which to call determiners, and which conditioners. A psychologist might focus his attention on individual factors, viewing group factors as context; a sociologist might do the reverse. If one manipulates certain variables, and simply measures others, the former usually have prior claim to the status of determiners.

What is called a "control" variable may have a function identical to that of conditioner, depending on the method used to hold it constant. If the control variable B is held constant by taking each level separately and observing the successive AY relationships, then B is identical to a conditioner. But if B is held constant by means of matched groups, partial correlation, or analysis of co-variance, then B cannot function as conditioner. Since the latter methods do not examine successive AY relationships, they cannot permit the interaction effect (if present) to appear.
Statistical procedures. Corresponding to the variety of labels for interaction phenomena, there exist a variety of statistical procedures for detecting them, and for estimating their magnitude and statistical significance.

(a) One procedure, illustrated in this paper, makes use of correlations. Correlation coefficients are computed between variables A and Y, under high and low values respectively of B. If the two correlations differ significantly, significant interaction is demonstrated.

(b) A more common procedure, illustrated in the Kendall and Lazarsfeld discussion, is to construct an A X B table (most simply, a 2 X 2 table) and within each cell compute a measure of Y such as mean or percent. For each level of B, the AY relation appears as a difference in mean Y or percent Y as A varies. The interaction effect (if any) then appears as a difference in the differences. To test statistical significance one computes an error term by summing the variances of the four means or percents.

(c) The above format can also be handled by analysis of variance, which is especially suitable if more than two levels of A or B are used. The interaction effect then appears as an A X B interaction component. Computational difficulties arise if A and B are themselves intercorrelated or non-orthogonal, and since this condition is to be expected in observational data, analysis of variance is difficult to use in practice.

(d) It would be desirable to have non-parametric techniques to detect interaction effects. Where all three variables are dichotomous (2 X 2 X 2 table), Snedecor (14, pp. 200-204) describes a chi-square method of Bartlett for testing the "second order interaction" (he calls first order interactions the relations between each pair of variables, analogous to main effects in analysis of variance.) Myers (9) describes an exact test for the same situation. Neither method is simple to compute.

It has long been known that chi-square can be partitioned into additive components. From a total chi-square, Sutcliffe (15) subtracts components due to the first order relations. The remainder reflects the second order interaction, and is assumed to distribute as chi-square.²

Whatever the form, interaction effects appear frequently, if one looks for them. But many methods prevent their appearance. None of the techniques based on a bivariate correlation matrix—such as factor analysis, partial correlation, the usual multiple correlation—can detect interaction effects. To do so requires tri-variate (or larger) tables—three or more variables studied at the same time.

The Present Study

We return to our central question: under what conditions will greater self-determination result in higher performance?

An opportunity to pursue this question was provided in a study which the Survey Research staff conducted in a large company manufacturing electrical products, which was undergoing rapid and planned growth.
**Setting**

In April, 1959 a 45-minute questionnaire was completed by employees in four parts of the organization: the engineering department in one of the major product divisions, the manufacturing department of the same division, the central research laboratories reporting to the vice-president for research, and small central staff divisions which performed accounting, personnel, and other service functions for the total organization.

Because of the different sizes of these four parts and their subdivisions, differing sample rates were used, ranging from 100% in the research and central staff offices to as low as 10% in some parts of manufacturing. Probability sampling methods were used. In computing all of the correlations reported below, weights were applied in accordance with the sampling rates. Estimates of statistical significance were conservatively based on the actual number in the samples.

**Independent Variables**

We attempted to measure (or at least to approximate) four independent variables or predictors which might interact in determining performance. The measures and their rationale are discussed below; specific hypotheses are given in the results section.

A. **Self-determination.** Two questionnaire items obtained respondent's perception of his autonomy (each item providing a five-category response scale): "How free do you feel to set your own work pace?" and "How much authority do you feel you have to make the decisions that you need in order to do an effective job?"

A third item measured perception of control: "To what extent do you feel you can influence the activities and decisions of your supervisors where these affect you?" The questions were all adapted from items in previous studies that showed some relation to performance.

Self-determination is not, of course, considered to be a single dimension. Intercorrelations among the three measures were modest but statistically significant (from .12 to .36). Answers were summed to form an index ranging from 3 (low) to 15.

B. **Self-motivation.** Intuitively, it seems likely that autonomy alone is not a sufficient stimulus for high performance. Also required is an internalized desire to do a good job, which must be available when external pressures are withdrawn. If and only if such motivation is present, will self-determination permit action to be directed toward high performance. Relevant are the findings of Vroom (17) and Tannenbaum and Allport (16).

We attempted, then, to measure the extent to which the individual has developed an internalized motivation to perform well in his job. In Lewin's terminology: the relative strength of "own" forces to perform well in contrast to "induced" forces. A recent study of such a variable is that of Slater (13) on "internalization of motivation toward role performance."
The following items were used: "If a problem comes up in your work and it isn't all settled by the time you go home, how likely is it that you find yourself thinking about it after work?" (from the Slater study). "Some people are completely involved in their jobs; others view their work merely as one of several interests. How involved do you feel in your work?"

Also, following a question concerning perception of pressure ("To what extent do you feel any pressure to do a better job—pressure either from yourself or from other people?"") the respondent was asked: "If you feel any pressure to do better, from what source does this mainly come?" (response categories ranged from "entirely from other people" to "entirely from myself”).

The first two items were found to correlate moderately (r = -23), while these did not correlate with the third. But the latter—perception of internal pressure to do better—has perhaps the greatest face validity. All three scores were therefore summed to form an index of self-motivation ranging from 3 (low) to 16.

Indices A and B were found to correlate (r = .29). This fact warrants one final emphasis on the distinction between interaction and intervening effects. Self-motivation may serve in both capacities. The intervening effect is this: in the long run, greater self- determination may arouse internal motivation, and this in turn may stimulate higher performance. (Thus in the Morse and Reimer study (8), employees in the autonomous program developed a higher sense of responsibility to get the work done, which may have helped to raise productivity.) But at any one point in time, self-motivation can also serve as conditioner. When it is strong, autonomy should show a greater correlation with performance, than when motivation is weak—regardless of whether the two predictors are correlated.

C. Flexibility of work setting. What of the objective situation (apart from variation in individual perceptions of autonomy and control)? How fixed or routinized are the procedures? What is the prevailing level of discretion allowed to members? These are aspects of what we may loosely call the "flexibility of work setting."

We would expect, of course, some correlation between A and C: in the more flexible situation the average self-determination should be higher. But within a single setting, variations in individual scores will occur.

On a priori grounds, one might expect the four departments to stand in this order from most to least flexible: 1) research, 2) engineering, 3) central staff (mixed levels of flexibility, ranging from imaginative marketing studies to routine data-processing), and 4) manufacturing.

As a check on this assumption, mean scores on measures A and B were examined and were found, in fact, to stand in the above order (although differences were slight). Mean self-determination scores respectively were 10.8, 10.5, 10.4, and 10.1. Mean self-motivation scores respectively were 13.1, 13.0, 12.6, and 12.1
D. Level of preparation for one's job. A person who has adequate skills and experience for his job may be expected to benefit by greater self-determination. Since he knows what to do and what not to do, autonomy permits him to make the best choices. The ill-prepared man, given autonomy, may simply blunder.

We had no direct measure of job preparation. But we did obtain level of formal education. The latter is highly valued in this engineering-oriented company. Even the assembly employees (for the most part) have completed high school; and a college degree is almost essential for rising to higher supervisory positions.

We therefore examined level of formal education in relation to grade level. Four categories of education (no high school, high school, college, doctorate) were tabulated against two distinctions of grade (1-9 versus 10 and up--roughly equivalent to non-supervisory versus supervisory status). Five of the eight cells had sufficient cases for analysis.

Dependent Variables: Performance (Y)

Because of rapid changes in technology, it was not possible to measure objective output. The company however put considerable effort into semi-annual performance reviews, in which each employee was rated by his immediate supervisor on ten job factors.

Factor analysis showed a strong halo effect and a single strong factor among the ten rating scales, with intercorrelations in the high 80's and 90's. We shall be interested mainly in the "overall performance index"--the average of ten ratings. In addition, analyses were performed on two sub-scales: "quality of work" and "initiative."

Hypotheses and Results

Joint Effects of Self-Determination (A) and Self-Motivation (B) on Performance

If the individual lacks internalized commitment to task, then self-determination may mean merely the freedom to slow down. But if he has high internalized motivation, then self-determination should correlate positively with performance. Hence:

Hypothesis 1a. When self-motivation (B) is high, the correlations between self-determination and autonomy (\( r_{AY} \)) will be more positive than when self-motivation is low.

The converse prediction can be made. If an individual lacks self-determination, his level of performance is likely to be fixed, regardless of whether he really wants to perform well. But if he has much autonomy, then his performance will depend considerably on his internal motivation. Hence:
Hypothesis lb. When self-determination (A) is high, the correlations between self-motivation and performance ($r_{BY}$) will be more positive than when self-determination is low.

A rough test of these hypotheses is made in Table 1. Hypothesis la predicts a positive difference between lines 1 and 2 of the table; hypothesis lb a positive difference between lines 4 and 5. Of six differences, five were in the expected direction, and two were large enough for statistical significance—both on the rating of initiative. And of the three performance measures, initiative is the one which—in terms of face validity—one would most expect to respond to these predictors.

Insert Table 1 about here

A more refined test of the hypotheses is possible with the data in Table 2. Here the same correlations were obtained separately within two departmental groups: engineering plus research, and manufacturing plus central staff. Hypothesis la predicts positive differences between lines 1 and 2 (within engineering and research), and between lines 3 and 4 (manufacturing and staff). Hypothesis lb predicts corresponding differences among lines 5 to 8. Results of these comparisons are shown in lines 9 to 12.

Insert Table 2 about here

Among the twelve comparisons, eight were in the predicted direction (positive), and three of these were statistically significant. The latter were all for hypothesis lb, which was thus more strongly supported than la. All the predictions for "initiative" were in the predicted direction.

Flexibility of Work Setting (C) Taken Jointly with Each of the Preceding Predictors

If the setting is relatively inflexible—procedures generally fixed—then differences in individual self-determination should have little effect. Autonomy might, in fact, harm performance by encouraging variations which are unacceptable to the organization. But if the setting is flexible, then those individuals with autonomy and influence might do an outstanding job, while those who simply follow instructions may be mediocre. Hence:

Hypothesis 2a. In research and engineering departments (considered to be more flexible), the correlations between self-determination and performance ($r_{AY}$) will be more positive than is the case in manufacturing and central staff departments (considered to be less flexible).

(A converse prediction could have been made, but was not examined: among self-determining individuals, departmental flexibility should correlate more positively with performance than is the case among non-self-determining individuals.)
Similar reasoning may be applied to interaction between flexibility and self-motivation. In a non-flexible setting, performance is relatively fixed by prescribed procedures; in a flexible setting, performance is more responsive to internal sources of motivation. Hence:

Hypothesis 2b. In research and engineering departments (more flexible), the correlations between self-motivation and performance ($r_{BY}$) will be more positive than is the case in manufacturing and staff departments (less flexible).

The data in Table 2 may also be used to test these hypotheses. Hypothesis 2a, for example, predicts a positive difference between the correlations in line 1 for engineering and research, and the comparable correlations in line 3 for manufacturing and staff. The necessary comparisons for both hypotheses appear in lines 13 through 16.

Among the twelve comparisons, seven were in the predicted direction (positive), and three of these were statistically significant. The trends supported both hypotheses 2a and 2b, especially the latter.

Thus, both self-determination and self-motivation correlated more highly with performance in flexible than in less flexible settings.

**Joint Effects of Three Predictors**

The same data also permit us to examine a more complex question: what effects may be predicted when all three predictors are examined jointly? Specifically: (i) Will the interaction effects of A and B with respect to Y (as in hypotheses 1a and 1b) be stronger in flexible departments, or in less flexible? (ii) Will the interaction effects of flexibility taken with each predictor (as in hypotheses 2a and 2b) be stronger when the third predictor is high or low?

Armchair speculation failed to generate any simple, intuitively plausible predictions. So let us simply see what happens in Table 2.

(i) Lines 9 through 12 each contain a measure of $A \times B$ interaction. Comparing line 9 with 10, and 11 with 12, we note that in all six comparisons the $A \times B$ interaction is more positive in engineering plus research, than in manufacturing plus staff.

Thus it is mainly in flexible settings that both high self-determination and high self-motivation are simultaneously required for high performance.

(ii) Likewise lines 13 through 16 show $A \times C$ and $B \times C$ interactions. In all six of these comparisons, interaction is more positive when the third variable is high than when it is low.

Statements (i) and (ii) really say the same thing; they look at the identical set of data from slightly differing viewpoints.\(^4\)
To repeat: when the setting is flexible, then the presence of high self-determination and self-motivation jointly seems helpful to high performance; if either factor is missing, the effect of the other is reduced. But when the setting is less flexible, then the joint presence of both factors seems to hinder performance; either factor alone yields better results.

A Simplified Analysis

The preceding analysis is not easy to follow. As an alternative, the simplified analysis shown in Table 3 may be clearer if less exact. Self-determination and self-motivation were dichotomized within each type of department, and for each of the resulting four cells a mean was computed on the three performance measures. Data are presented as deviations from the respective department means.

Within engineering plus research, above-average performance on all three measures appeared only when A and B predictors were simultaneously high (fourth line in each section of the table). If either of these was low, then increase in the other had no effect (or even a negative effect).

Within manufacturing plus central staff, on the other hand, best performance tended to appear when one of the factors was high while the other was low—as observed for overall performance index, and the rating of quality. Only the rating of initiative tended to show a slight superiority when both predictors were simultaneously high.

Scrutiny will show that these differences in means tend to correspond to the correlations reported previously. Exact correspondence is not to be expected, of course, since some information is lost by collapsing.

Preparation for One's Job (D)

As mentioned earlier, we had no direct measure of job preparation, but we did obtain level of formal education in relation to job grade. The rough prediction is:

Hypothesis 3a. Among persons with high education relative to job grade, the correlations between self-determination and performance \( r_{AX} \) will be more positive than among persons with low education relative to grade.

(The corollary prediction was not examined: that among self-determining persons, level of preparation should relate more highly to performance than among non-self-determining persons.)

A similar prediction may be made with respect to self-motivation. If a man is well prepared for his job, then when he is motivated he should do it better than when he is unmotivated. If he is poorly prepared, then strong motivation may not help him. The rough prediction is:
Hypothesis 3b. Among persons with high education relative to job grade, the correlations between self-motivation and performance ($r_{BY}$) will be more positive than among persons with low education relative to grade.

(Again the corollary prediction was not examined.)

Five combinations of education-in-relation-to-grade, called "job levels," had sufficient cases for analysis. Data for these are shown in Table 4.

Predictions may be made for several pairs of job levels. (a) Correlations should be more positive at job level II than at I (both are in grades 1-9, but those in II have more education). (b) Correlations should be more positive at level IV than at V (both have college degrees, but those in V have more difficult jobs).

Job level III may be compared with two others. Correlations should be (c) more positive at level II than at III (same education, but the III's have harder jobs), and (d) more positive at V than at III (same difficulty, but the III's have less education).

The basic $AY$ correlations are shown in lines 1-10 of Table 4, while the $BY$ correlations appear in lines 11-20.

Comparisons to test hypothesis 3a appear in lines 21-28. In each instance the hypothesis predicts a positive difference (positive $A \times D$ interaction). Among 24 comparisons the difference was positive in 14 cases, in two cases significantly so. But in the 10 remaining comparisons the difference was negative—in two cases of sufficient size to be statistically significant. Thus hypothesis 3a received only mild support, and evidenced some sharp exceptions.

Comparisons to test hypothesis 3b appear in lines 29-36 ($B \times D$ interactions, all predicted to be positive). Among 24 comparisons, 15 were found to be positive, five significantly so; and nine were negative (one of these significant). Thus hypothesis 3b was fairly well supported.

Can we make any sense of the puzzling negative interactions noted in lines 26, 28, 34, and 36?

These were all generated by strong positive correlations in lines 6 and 16, for persons at job level III (high school only, in grades 10 and up). When and only when these persons had a low degree of either self-motivation or of self-determination, did the other factor correlate positively with performance.

Of all five levels, employees at III may be considered the most under-prepared for their jobs. Possessing limited education, they occupy grades of supervisory status, competing with people most of whom have college degrees. We may surmise that they feel psychologically insecure.
The following interpretation may be justified: When an individual is under-prepared for his job (relative to co-workers in similar jobs), then self-determination can help him only if he is not internally motivated—that is, only if he pursues goals set by other people. Similarly, self-motivation can help him only if he is not self-determining—that is, only if he follows procedures established by other people. If he experiences both conditions jointly, his insecurity may be exaggerated, and his performance hindered.

In Conclusion

Some Speculations

Especially interesting were certain triple interaction effects, for which no predictions had been made. Employees in less flexible departments were observed to perform better if they were self-determining but not strongly self-motivated, or if motivated but not self-determining. A parallel effect was noted for employees who were educationally under-prepared in relation to job difficulty.

Is there a connection between these two phenomena? (It will be noted that they are not connected by artifact. The proportion of under-prepared employees at job level III is no greater in manufacturing plus staff than in engineering plus research.)

Some conceptual connections between the two findings may be suggested. In the first place, educational under-preparation (D) may create conditions for the individual that are similar to departmental inflexibility (C). The under-qualified man perhaps shuns responsibility, seeks security in fixed procedures, creates an immediate non-flexible setting for himself.

Second, self-determination (A) and self-motivation (B) are similar, in that both imply an active stance toward the environment—not passive. Both imply a reduction in the external or "induced" pressures on the individual (in the Lewinian sense), and an increase in internal or "own" pressures.

The following intuitive hypothesis may be proposed:

The more flexible (or less rigid) the environment within which the individual acts, the more must internal pressures predominate over external, if high performance is to be maintained. Maximum performance, however, will occur if the net level of internal pressures does not greatly exceed what is normal for that environment.

This is not a rigorous hypothesis, since several terms are undefined. Nevertheless it seems to make sense of the observed data. Where flexibility of the situation is greatest (engineering plus research, or full preparation for job), then the presence of both internal factors is essential to high performance. Where flexibility is moderate (manufacturing plus staff, or under-preparation for job), one internal factor without the other leads to better performance.
A further prediction can be generated, though not testable with present data. If the environment were completely rigid, one would expect that any amount of internal factors would have a detrimental effect on performance (as judged by organizational standards).

Summary

In a rapidly growing company manufacturing electrical products, questionnaire data were obtained to measure the individual's self-determination (including both autonomy and influence), and self-motivation (internalized desire to perform well on the job). Performance measures consisted of ratings by supervisors.

Three hypotheses were presented concerning interaction effects—e.g., the correlation between one independent variable (predictor) and performance was expected to differ, depending upon the level of a second predictor. All hypotheses were supported in part or in full by the following results:

1. Self-determination was more positively correlated with performance when: a) the individual was strongly self-motivated toward the task; b) the work setting was flexible (engineering plus research departments) rather than less flexible (manufacturing plus central staff).

2. Results were still clearer for the measure of self-motivation. This variable was more positively correlated with performance when: a) the individual was highly self-determining; b) the work setting was flexible; c) the individual's formal education was high relative to job difficulty.

Findings 1a and 2a taken together are roughly equivalent to saying that performance was high only when self-determination and self-motivation was both present at a high level, and not when either occurred alone.

The magnitude of this joint effect was found to vary with the other two factors (triple interaction effects). In flexible departments, and among persons well prepared educationally for their jobs, performance was best when both self-determination and self-motivation were simultaneously high. But in less flexible departments, and among employees under-prepared for their jobs, overall performance was better if the employee had either self-determination alone, or self-motivation alone, and not both.

A speculative interpretation suggested that for maximum performance (by organizational standards), the net level of internal pressures should rise as the flexibility of the situation increases, but should not greatly exceed what is normal to the situation.
References


Footnotes

1. The author is grateful to Peter T. Schneider, who assisted in construction of indices and preliminary analysis, and to Mrs. Ellen Landau, who performed the statistical tabulations and computations. The study from which these data were drawn was directed by Victor H. Vroom. For financial support we are indebted to the company (which must remain anonymous).

2. In personal communications (1955-56), J. E. K. Smith expressed doubt as to the last assumption. He suggested however that since ratios between chi-squares are distributed as $F$, one might test with $F$ the ratio between total chi-square and the sum of the first order interactions. The presence of second order interaction in the former should increase the ratio significantly.

3. Since the same data are simply examined in different ways to test these two interaction effects, they are not strictly separate predictions. If one effect is found, the other will tend to be also. In fact, if interaction is examined by any of the other statistical techniques described earlier, only a single interaction effect is obtained. It might be interpreted in support of either hypothesis 1a or 1b.

4. What they illustrate are triple interaction effects ($A \times B \times C$). With the method employed here, they can be given a sign. Since the $A \times B$ interactions are more positive when flexibility ($C$) is high, the triple effects may be called positive. Note that the triple interaction in lines 9 vs. 10 is identical with that in lines 13 vs. 14, since

$$(9 - 10) = (1 - 2) - (3 - 4) = 1 - 2 - 3 + 4;$$

and (13 - 14) comes to the same thing. The statistical significance of this term could be assessed with $z$-transformations for each of four $r$'s:

$$t = \frac{z_1 - z_2 - z_3 + z_4}{\sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3} + \frac{1}{N_3 - 3} + \frac{1}{N_4 - 3}}}$$
Table 1

Self-Determination (A) and Self-Motivation (B),
as Each Correlates with Three Measures of Performance (Y)
When the Other is Controlled

<table>
<thead>
<tr>
<th>Line</th>
<th>Type of correlation</th>
<th>N</th>
<th>Perf. Index</th>
<th>Quality</th>
<th>Initiative</th>
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<td>.31*</td>
<td>.11</td>
<td>.33*</td>
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<tr>
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<td>𝑟_{AY}; B low</td>
<td>238</td>
<td>.29*</td>
<td>.15*</td>
<td>.15*</td>
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<tr>
<td>3.</td>
<td>Difference^c</td>
<td></td>
<td>+.02</td>
<td>-.04</td>
<td>+.18**</td>
</tr>
<tr>
<td>4.</td>
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<td>.21*</td>
<td>.19*</td>
<td>.25*</td>
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<td>.11</td>
<td>.16*</td>
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</tr>
<tr>
<td>6.</td>
<td>Difference^c</td>
<td></td>
<td>+.10</td>
<td>+.03</td>
<td>+.32**</td>
</tr>
</tbody>
</table>

^aShown here and in following tables are product-moment correlations, weighted for sampling rates. N's shown are actual cases (unweighted), used to test statistical significance.

^bThe expression 𝑟_{AY}; B high (for example) indicates the correlation between self-determination (A) and the three measures of performance (Y) successively, for employees having high self-motivation (B).

^cIn each comparison a positive difference is predicted. Significance tested by means of differences in z-transformations.

*Correlation is statistically significant at .05 level (two-tailed test).

**Difference between r's is in predicted direction and statistically significant at .05 level (one-tailed test).
Table 2

Self-Determination (A) and Self-Motivation (B) as Related to Three Performance Measures (Y) in Departments Differing as to Flexibility (C)

<table>
<thead>
<tr>
<th>Line</th>
<th>Department</th>
<th>Correlation</th>
<th>N</th>
<th>Perf. Index</th>
<th>Quality</th>
<th>Initiative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Eng. + Research</td>
<td>$r_{AY}$; B high</td>
<td>94</td>
<td>.33*</td>
<td>.26*</td>
<td>.36*</td>
</tr>
<tr>
<td>2.</td>
<td>&quot;</td>
<td>$r_{AY}$; B low</td>
<td>127</td>
<td>.20*</td>
<td>.06</td>
<td>.20*</td>
</tr>
<tr>
<td>3.</td>
<td>Mfg. + Staff</td>
<td>$r_{AY}$; B high</td>
<td>51</td>
<td>.12</td>
<td>-.05</td>
<td>.23</td>
</tr>
<tr>
<td>4.</td>
<td>&quot;</td>
<td>$r_{AY}$; B low</td>
<td>111</td>
<td>.41*</td>
<td>.23*</td>
<td>.12</td>
</tr>
<tr>
<td>5.</td>
<td>Eng. + Research</td>
<td>$r_{BY}$; A high</td>
<td>114</td>
<td>.37*</td>
<td>.32*</td>
<td>.42*</td>
</tr>
<tr>
<td>6.</td>
<td>&quot;</td>
<td>$r_{BY}$; A low</td>
<td>107</td>
<td>.02</td>
<td>-.01</td>
<td>-.01</td>
</tr>
<tr>
<td>7.</td>
<td>Mfg. + Staff</td>
<td>$r_{BY}$; A high</td>
<td>66</td>
<td>-.08</td>
<td>.08</td>
<td>.06</td>
</tr>
<tr>
<td>8.</td>
<td>&quot;</td>
<td>$r_{BY}$; A low</td>
<td>96</td>
<td>.07</td>
<td>.24*</td>
<td>-.18</td>
</tr>
</tbody>
</table>

Differences in $r$'s\(^a\)

Hypothesis 1a: $r_{AY}$ as B varies
9. Within Eng. + Research... Line 1 - 2 = +.13 +.20 +.16
10. " Mfg. + Staff...... Line 3 - 4 = -.29 -.28 +.11

Hypothesis 1b: $r_{BY}$ as A varies
11. Within Eng. + Research... Line 5 - 6 = +.35** +.33** +.43**
12. " Mfg. + Staff...... Line 7 - 8 = -.15 -.16 +.24

Hypothesis 2a: $r_{AY}$ as C varies
13. When B is high...... Line 1 - 3 = +.21 +.31** +.13
14. When B is low...... Line 2 - 4 = -.21 -.17 +.08

Hypothesis 2b: $r_{BY}$ as C varies
15. When A is high...... Line 5 - 7 = +.45** +.24 +.36**
16. When A is low...... Line 6 - 8 = -.05 -.25 -.17

\(^a\)Significance of difference tested by means of differences in z-transformations. In each of lines 9-16, a positive difference is predicted.

*Correlation is statistically significant at .05 level (two-tailed test).

**Difference in correlations is in predicted direction and statistically significant at .05 level (one-tailed test).
Table 3

Mean Performance under Different Combinations of Self-Determination and Self-Motivation

(shown are deviations from departmental means)

<table>
<thead>
<tr>
<th>A. Self determination</th>
<th>B. Self-motivation</th>
<th>Engineering plus Research</th>
<th>Manufacturing plus Central Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
<td>-4</td>
<td>-3</td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>-2</td>
<td>-2</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>-4</td>
<td>+4</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
<td>+5</td>
<td>+2</td>
</tr>
</tbody>
</table>

Rating of quality

| Low                   | Low                | -.2                      | -.3                             |
| Low                   | High               | -.1                      | +.3                             |
| High                  | Low                | -.5                      | -.1                             |
| High                  | High               | +.4                      | +.1                             |

Rating of initiative

| Low                   | Low                | -.5                      | -.3                             |
| Low                   | High               | -.5                      | -.5                             |
| High                  | Low                | -.7                      | +.3                             |
| High                  | High               | +.6                      | +.4                             |
Table 4

Self-Determination (A) and Self-Motivation (B) as Related to Performance (Y) at Job Levels Differing as to Employee Preparation (D)

<table>
<thead>
<tr>
<th>Line</th>
<th>Level</th>
<th>Educ.</th>
<th>Grade</th>
<th>Correlation</th>
<th>N</th>
<th>Perf. Index</th>
<th>Quality</th>
<th>Initiative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I</td>
<td>Non-HS</td>
<td>1-9</td>
<td>$r_{AY}$; B high</td>
<td>15</td>
<td>.40</td>
<td>.05</td>
<td>-.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$r_{AY}$; B low</td>
<td>21</td>
<td>.01</td>
<td>-.13</td>
<td>-.18</td>
</tr>
<tr>
<td>2.</td>
<td>II</td>
<td>HS only</td>
<td>1-9</td>
<td>$r_{AY}$; B high</td>
<td>88</td>
<td>.29*</td>
<td>.14</td>
<td>.30*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$r_{AY}$; B low</td>
<td>67</td>
<td>-.01</td>
<td>-.04</td>
<td>-.11</td>
</tr>
<tr>
<td>3.</td>
<td>III</td>
<td>HS only</td>
<td>10+</td>
<td>$r_{AY}$; B high</td>
<td>21</td>
<td>-.01</td>
<td>.09</td>
<td>.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$r_{AY}$; B low</td>
<td>22</td>
<td>.59*</td>
<td>.42</td>
<td>-.04</td>
</tr>
<tr>
<td>4.</td>
<td>IV</td>
<td>BA, MA</td>
<td>1-9</td>
<td>$r_{AY}$; B high</td>
<td>16</td>
<td>.28</td>
<td>.28</td>
<td>.55*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$r_{AY}$; B low</td>
<td>15</td>
<td>.28</td>
<td>.33</td>
<td>.36</td>
</tr>
<tr>
<td>5.</td>
<td>V</td>
<td>BA, MA</td>
<td>10+</td>
<td>$r_{AY}$; B high</td>
<td>36</td>
<td>.21</td>
<td>.02</td>
<td>.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$r_{AY}$; B low</td>
<td>49</td>
<td>-.06</td>
<td>-.21</td>
<td>.01</td>
</tr>
<tr>
<td>6.</td>
<td>I</td>
<td>Non-HS</td>
<td>1-9</td>
<td>$r_{BY}$; A high</td>
<td>21</td>
<td>.25</td>
<td>.09</td>
<td>-.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$r_{BY}$; A low</td>
<td>25</td>
<td>-.28</td>
<td>.36</td>
<td>.14</td>
</tr>
<tr>
<td>7.</td>
<td>II</td>
<td>HS only</td>
<td>1-9</td>
<td>$r_{BY}$; A high</td>
<td>88</td>
<td>.31*</td>
<td>.41*</td>
<td>.27*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$r_{BY}$; A low</td>
<td>67</td>
<td>.08</td>
<td>.22</td>
<td>-.08</td>
</tr>
<tr>
<td>8.</td>
<td>III</td>
<td>HS only</td>
<td>10+</td>
<td>$r_{BY}$; A high</td>
<td>21</td>
<td>-.32</td>
<td>-.34</td>
<td>-.24</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$r_{BY}$; A low</td>
<td>22</td>
<td>.49*</td>
<td>.50*</td>
<td>.12</td>
</tr>
<tr>
<td>9.</td>
<td>IV</td>
<td>BA, MA</td>
<td>1-9</td>
<td>$r_{BY}$; A high</td>
<td>13</td>
<td>.32</td>
<td>.26</td>
<td>.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$r_{BY}$; A low</td>
<td>18</td>
<td>.15</td>
<td>.16</td>
<td>-.11</td>
</tr>
<tr>
<td>10.</td>
<td>V</td>
<td>BA, MA</td>
<td>10+</td>
<td>$r_{BY}$; A high</td>
<td>46</td>
<td>.10</td>
<td>.14</td>
<td>.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$r_{BY}$; A low</td>
<td>39</td>
<td>-.12</td>
<td>.07</td>
<td>-.05</td>
</tr>
</tbody>
</table>

(continued)
(Table 4 (cont.))

Differences in r's

**Hypothesis 3a: \( r_{AY} \) as D varies**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th>Line</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>21.</td>
<td>II vs. I,</td>
<td>B high</td>
<td>....</td>
<td>3 - 1</td>
<td>-.11</td>
<td>+.09</td>
</tr>
<tr>
<td>22.</td>
<td>&quot;</td>
<td>B low.</td>
<td>....</td>
<td>4 - 2</td>
<td>-.02</td>
<td>+.09</td>
</tr>
<tr>
<td>23.</td>
<td>IV vs. V,</td>
<td>B high</td>
<td>....</td>
<td>7 - 9</td>
<td>+.07</td>
<td>+.26</td>
</tr>
<tr>
<td>24.</td>
<td>&quot;</td>
<td>B low.</td>
<td>....</td>
<td>8 - 10</td>
<td>+.34</td>
<td>+.54**</td>
</tr>
<tr>
<td>25.</td>
<td>II vs. III,</td>
<td>B high</td>
<td>....</td>
<td>3 - 5</td>
<td>+.30</td>
<td>+.05</td>
</tr>
<tr>
<td>26.</td>
<td>&quot;</td>
<td>B low.</td>
<td>....</td>
<td>4 - 6</td>
<td>-.60***</td>
<td>-.46</td>
</tr>
<tr>
<td>27.</td>
<td>V vs. III,</td>
<td>B high</td>
<td>....</td>
<td>9 - 5</td>
<td>+.22</td>
<td>-.07</td>
</tr>
<tr>
<td>28.</td>
<td>&quot;</td>
<td>B low.</td>
<td>....</td>
<td>10 - 6</td>
<td>-.65***</td>
<td>-.63***</td>
</tr>
</tbody>
</table>

**Hypothesis 3b: \( r_{BY} \) as D varies**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th>Line</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>29.</td>
<td>II vs. I,</td>
<td>A high</td>
<td>....</td>
<td>13 - 11</td>
<td>+.06</td>
<td>+.32</td>
</tr>
<tr>
<td>30.</td>
<td>&quot;</td>
<td>A low.</td>
<td>....</td>
<td>14 - 12</td>
<td>+.36</td>
<td>-.14</td>
</tr>
<tr>
<td>31.</td>
<td>IV vs. V,</td>
<td>A high</td>
<td>....</td>
<td>17 - 19</td>
<td>+.22</td>
<td>+.12</td>
</tr>
<tr>
<td>32.</td>
<td>&quot;</td>
<td>A low.</td>
<td>....</td>
<td>18 - 20</td>
<td>+.27</td>
<td>+.09</td>
</tr>
<tr>
<td>33.</td>
<td>II vs. III,</td>
<td>A high</td>
<td>....</td>
<td>13 - 15</td>
<td>+.63**</td>
<td>+.75**</td>
</tr>
<tr>
<td>34.</td>
<td>&quot;</td>
<td>A low.</td>
<td>....</td>
<td>14 - 16</td>
<td>-.41</td>
<td>-.38</td>
</tr>
<tr>
<td>35.</td>
<td>V vs. III,</td>
<td>A high</td>
<td>....</td>
<td>19 - 15</td>
<td>+.42</td>
<td>+.48**</td>
</tr>
<tr>
<td>36.</td>
<td>&quot;</td>
<td>A low.</td>
<td>....</td>
<td>20 - 16</td>
<td>-.61***</td>
<td>-.43</td>
</tr>
</tbody>
</table>

---

*In each of lines 21-36, positive differences are predicted.

*Correlation significant at .05 level (two-tailed test).

**Difference in correlations is in predicted direction and significant at .05 level (one-tailed test).

***Difference is opposite to prediction, and significant at .05 level (two-tailed test).