Volume 49, No. 3 Fall 1996

Using Sociometry to Predict Team Performance in the Work Place

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ABSTRACT. Teams are becoming an increasingly popular way to improve performance and quality in the work place. Little research, however, has addressed the question of how to predict high performance from individuals who are placed on teams. Sociometry can provide an alternative to previous methods by measuring preferred pairings among team members across a number of tasks or settings. The choices given and received among members within a social network can reveal the degree of mutual preference for working together, and is referred to as the group's density. In this study, the survey method was used to measure 29 squads at a military college for their density as well as for the level of satisfaction and perceived cohesion among team members. Sociometric strong or dense teams were found to perform better across a combination of several different criterion measures. Implications for future research and applied uses in organizations are discussed.

RECENT TRENDS IN ORGANIZATIONAL PRACTICE, such as the increasing use of quality circles, autonomous work groups, project teams, and management task forces, suggest that groups are becoming more pervasive in organizations (Hackman, 1987) and are recognized as a vital means of staying competitive and productive in the United States (Reich, 1987). Reduced bureaucracy, increased employee involvement, and high quality are all potential benefits gained from the use of teams in organizations, the most important of which is quality. Quality must be stressed in every facet of corporate life and can best be achieved through effective composition and execution of work by teams.

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The success of work teams in Japan, coupled with the desire to reduce bureaucratic waste, has caused a resurgence of interest in the use of work teams in America. If work is to be done by teams, then it follows that the quality of the product or service the team provides depends on the quality of the team itself (Chance, 1989). Although cognitive ability is important for almost any job, other issues may also be important when individuals work in groups—for example, good interpersonal skills. More research is needed to determine what factors create high performance and group-member satisfaction in a team context. In fact, research on work teams continues to demand considerable attention (Bettenhausen, 1991) and has for some time been considered relatively dormant (Gladstein, 1984). As Driskell, Salas, and Hogan (1987) have noted:

> The military promotes effective task performance primarily through personnel selection and training. Selection is based largely on tests of ability and aptitude. Little is known, however, regarding the nontechnical factors that determine team performance above and beyond individual technical competency.

This statement is true of private organizations as well. Few substantive findings have emerged as useful guides for creating and maintaining effective work teams. Existing generalizations are neither strong nor stable enough to serve as guides for managerial practice; and when statistically reliable results have been found, they are weak or dependent on a particular task and situational context (Hackman, 1987).

Personality has been proposed as a useful composition tool and predictor of team performance. Psychological tests have been used by some employers in an effort to find people with a "team personality" (Chance, 1989). The basic idea behind the personality test approach is to match people with either similar personalities, so that members will be compatible and able to work together efficiently, or different personalities, to produce a heterogeneous group that will generate different ideas or approaches that reflect the different personalities of the group.

Personality is undoubtedly important in a team's composition, performance, and overall effectiveness; however, questions have been raised concerning the study of personality and the use of personality tests as tools for predicting or identifying effective work teams. Sorenson (1973) has noted that research on personality has produced an extensive but not highly cumulative research tradition. Kahan, Webb, Shavelson, and Stolzenberg (1985) stated that it does not appear promising at the present time to use personality measures in determining group composition. Some research has shown that heterogeneous personalities tend to perform better on particular tasks, particularly problem-solving tasks, but the evidence is not completely consistent (Guzzo & Shea, 1992). Although personality is inherently believed to be important, research in this area continues to be equivocal.

Furthermore, whether or not personality is an appropriate avenue for team diagnosis is questionable. Personality tests are *individual* measures, whereas a team is an aggregate of individuals. Personality tests may not be the best measures of whether team members will work well with each other. A more appropriate method of analysis may be one that measures the individual in relation to the group instead of just the individual, as teams are a group-related phenomenon.

An alternative measurement tool that may provide more insight and predictive usefulness regarding team performance is sociometry, which is a technique for mapping the relationships of attraction and rejection among members of a group. Using sociometry, one can determine the degree to which individuals are accepted in a group, for discovering the relationships that exist among these individuals, and for disclosing the structure of the group itself (Ary, Jacobs, & Razavieh, 1990; Northway, 1967). Moreno (1934) devised this approach to examine patterns of interaction and the general organization of groups.

Knowledge about a group attained through the use of sociometry can be considerable, revealing informal leaders, isolates, or outcasts, and informal social networks and subgroups that can also be viewed as potential teams. What is invaluable about sociometry is that it provides an actual picture of the social interaction among group members, which may, through further research, facilitate understanding of *why* members interact as they do.

A typical sociometric test would ask a member of a particular group to make choices, among other group members, based on some criterion, such as with whom he or she preferred to work. A large share of choices is usually garnered by a few individual members, and smaller patterns of interaction among subsets of people emerge. These groups or subsets can then be measured to determine how strong or *dense* (Knoke & Kuklinski, 1982) they are, based on the number of choices garnered *by* individuals in the group *from* individuals in the group.

The density score reflects the degree of mutual preference among individuals for working together, socializing, or whatever criterion is used to make choices. Density is simply a rate of choices received to the total number of choices possible within a particular group. A typical sociogram, which shows the subjects as circles and their choices made and received as arrows, looks like Figure 1.

In Figure 1, we see a five-person group and their choices given and received by members of the group toward other members of the same group. Other choices that may have been given and received outside the immediate group are not shown in this example. However, larger groups of 50 or more are often studied in an exploratory manner to discover what kinds of subgroupings emerge. In these cases, all of the choices within the larger network are shown in order to disclose the smaller subgroups that exist within the larger network.

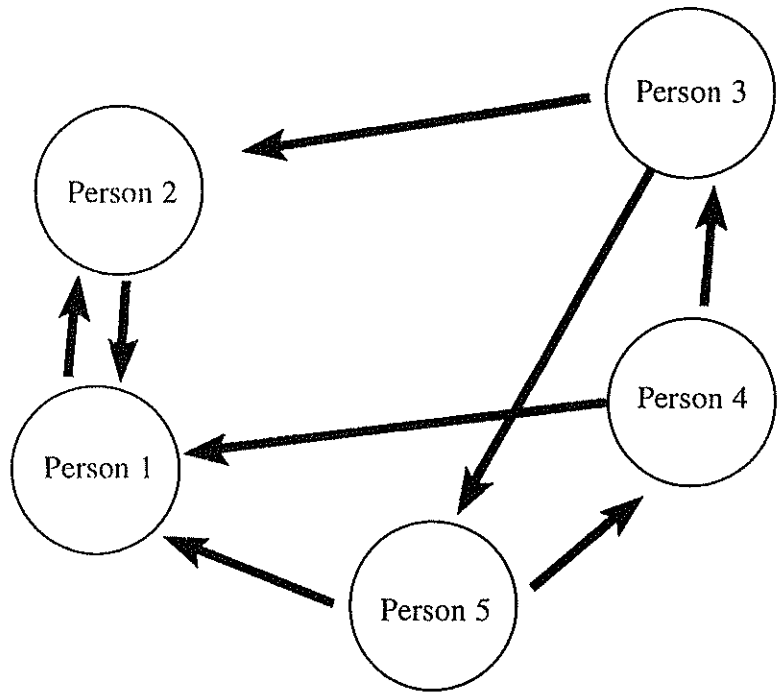

FIGURE 1. A sociogram of a five-person group.

The implicit theory of many researchers using sociometry is that team members who have a high degree of mutual preference for working together will perform better on a variety of tasks. Past studies using this method have had mixed results. French (1951) studied the choice structure of companies of naval recruits and found that the frequency of sick-bay attendance was negatively related to sociometric choice by peers but leadership ratings were positively related to sociometric scores.

Van Zelst (1952) found that carpenters and bricklayers who were paired sociometrically were considerably more productive than were pairs who were assembled arbitrarily. Goodacre (1951) found that combat squads that were more cohesive, as measured by a sociometric test, had higher scores on a field performance test consisting of various tactical situations. Roby (1968), however, found that the sociometric scores of members were unrelated to ratings of the effectiveness of aircrews, and Tziner and Vardi (1982) found that neither cohesiveness, measured via sociometry, nor command style, taken sepa-

rately, affected the performance effectiveness of tank crews, but only by their interaction.

The problems with past research using sociometry are twofold—theoretical and methodological. The first problem is that some researchers, including those previously cited, have often assumed that sociometry is a measure of group cohesiveness and satisfaction without validating sociometry with other self-report measures. At this time it is not clear whether sociometry measures or predicts group cohesion or satisfaction or whether a team will perform well.

A second problem is that few, if any, studies have reported statistical methods more intricate than a simple correlation or an analysis of variance (ANOVA). Advanced techniques such as multivariate analysis were not as widespread or understood when a large portion of research using sociometry was done in the 1950s and 1960s. Also, advanced tools such as computer programs like COMPSOC (Computerized Sociometry; Treadwell & Leach, 1987) and network analysis (Knoke & Kuklinski, 1982) were not available until recently. Thus early sociometric research could be done only by hand, which may in itself explain the decline in popularity of this method. Our current research is an attempt to bridge some of these gaps. Our hypotheses for this study were the following:

1. Teams that are more dense in terms of sociometric choice will be more cohesive as a team.
2. Sociometrically dense teams will be more satisfied than less-dense teams in terms of members' association with the team.
3. Sociometrically dense teams will be more effective than less-dense teams in terms of job performance.

Method

Participants

Participants were 129 cadets attending a military college in the southeastern United States. All were between the ages of 18 and 21 (121 men, 8 women) and were mostly freshmen along with some sophomores who had been together approximately 1 to 2 years. For this experiment, the cadets were arranged in 29 squads.

Materials

A sociometric questionnaire was administered to all of the cadets who participated in this study. Each participant was asked to pick his or her top choices for whom to be associated with in four different scenarios, indicated with a fill-in-the-blank-type format. Each team member was instructed to nominate

precisely as many individuals as currently existed in the present group, to control for potentially confounding effects of different base rates.

To test Hypotheses 1 and 2, we needed cohesion and satisfaction measures. One measure useful for such purposes is the Team Diagnostic Survey (Campbell & Hallam, 1991). Respondents are asked to indicate how much they agree with each of 93 statements. The items are clustered into homogeneous subscales, each designed to measure an aspect of the team that research indicates may be related to a team's ability to perform well. The survey taps into a large number of dimensions that are team related, ranging from the clarity of the team mission to whether the team is meeting its objectives. Although an overall difference in strength between the more- and less-dense squads is expected, based on past research, sociometrically dense teams are expected to show particularly higher scores on the items that measure team unity, team satisfaction, and performance.

The Unity subscale contains six items designed to measure whether members like each other and feel comfortable around one another as a group. The Satisfaction subscale contains four items that assesses whether members, overall, are satisfied or happy to be part of the team. The Performance subscale contains six items that measure whether members feel the team is meeting its objectives and is keeping its constituents happy.

To test Hypothesis 3, we needed measures of effectiveness that the college considered indicative for assessing the performance of their squads. One measure used is from a series of military field exercises known as Squad Progress. Squad Progress involves over 80 different elements for which the squad is held responsible. A majority of the elements measure drill-related tasks, such as presenting arms, marching, and standing at attention, but personal appearance and weapons appearance are rated as well. All items are rated on a 1- to 3-point scale ranging from *poor* to *outstanding*. The squad receives one overall score based on a sum of the items. Each member of the squad is held accountable for his or her squad progress score.

Flag duty, another task that squads perform, involves the proper ceremonial procedures of raising, lowering, and folding the American flag. Though this sounds like a simple procedure, there are 25 subtasks that the squad must complete. The different elements of flag duty include preparing the cannon that signals the lowering of the flag, presenting arms, and correctly "folding the colors." Each element is rated either satisfactory or unsatisfactory, and all the members receive the same score for which they are held responsible.

All squads were also measured by the performance dimension of the Campbell-Hallam survey previously described. Only criteria that were designed to capture variance at the group level were studied for this analysis, as teams were the focal unit of the study. Although the unit of measurement for these

self-report measures is at the individual level, the focal unit and unit of analysis that these measures were designed for is the group level.

Design and Procedure

The participants were administered a questionnaire booklet containing the Campbell-Hallam (1991) Team Diagnostic Survey and a sociometric questionnaire during one of their regularly scheduled military science classes. They were requested to answer as openly and honestly as possible, and they were assured complete confidentiality of their results.

Once the data were gathered, they were analyzed first by the Computerized Sociometry (COMPSOC) program (Treadwell & Leach, 1987). COMPSOC is a relatively easy-to-use program that saves a considerable amount of time and effort over previous methods done by hand. The program does this by providing a number of useful profiles, including an analysis of choices made and received by each person, a list of people in rank order by the number of choices received, and an analysis of the group structure.

Although sociometry provides a useful diagram of the interactions among team members, a metric was needed so that comparisons between teams could be made. Sociometric density was measured using a formula based on network analysis (Knoke & Kuklinski, 1982). This is a ratio of the number of choices given within the group to the total number of choices possible within the group. For example, Figure 1 shows that there were eight choices received by the members in the group. That is, when each person was asked whom he/she would prefer to work with, out of any choice possible regardless of current group assignments, 8 out of a possible 20 ($N^2 - N$) choices were received by members in the current team arrangement for this particular group. This yielded a density ratio of .4 out of a possible 1.0. Thus the higher the density, the more choices received by members within the group.

The calculation of the team's density is the crux of the entire study. The density score is what gives an indication of each group member's preferences for one another and actually attaches a numeric value representing just how strong those preferences are. Density, then, is an appropriate metric when one desires to have a direct measure of who endorses whom, which could be valuable when trying to decipher individuals who may bond and subsequently perform well as a team. This is why a measure of density was chosen for this study; it offers a more direct estimate of how the team members feel about each other and their compatibility within the group than past research using measures such as personality inventories.

Once the squad densities were determined, these scores were compared with scores on the Team Diagnostic Survey as well as performance criterion measures used at the college. Correlation/regression designs were used to test

each of the hypotheses. The first two hypotheses, that dense teams would be more cohesive and more satisfied, were tested with simple Pearson product–moment correlations between density and scores on each of the two subscales, Unity and Satisfaction, as measured by the Team Diagnostic Survey.

The last hypothesis, that denser teams would be more effective in terms of job performance than less-dense teams, was tested using multivariate multiple regression (Pedhazur, 1982), with the performance measures previously mentioned used as criterion variables and the density score as the predictor variable.

A .10 level of significance was adopted to increase the study's poor powa result of the small sample size. Though the .05 level is more the norm in psychological research, there is no magic behind this value. For purposes here, a more lenient alpha of .10 still provides enough protection from Type I error without masking what may be a promising line of future research (Stevens, 1986).

Results

The first hypothesis, that high-density teams would be more cohesive, was not supported, correlating weakly ($r = .14$, $p > .10$) with scores from the Unity subscale. This result is problematic, however, because the Unity subscale had an internal consistency of only .59 with the sample used here. One of the items was omitted to improve the internal consistency to .79, but the overall effect was still insignificant ($r = .17$, $p > .10$). Density scores ranged from .1 to .87.

The second hypothesis, that high-density teams would be more satisfied, was supported as measured by the Satisfaction subscale, $r = .31$, $p < .10$. This scale had an internal consistency of .80 with the college sample.

The third hypothesis, that denser teams would be more effective in terms of job performance, was supported by the multivariate regression, Wilks's lambda = .689, $F(3, 17) = 2.560$, $p = .089$. Because of missing data, only 21 teams were accepted for the analysis.

Table 1 contains some of the more common statistics found in a regression

TABLE 1
Regression Statistics for Each Criterion Variable Predicted by Overall Sociometric Density

Variable	Multiple R^2	β	F	p
Performance subscale	.07	.26	1.35	.26
Squad progress	.13	.36	2.90	.10
Flag duty	.04	.19	.71	.41

analysis. A look at the beta column, which is equivalent to multiple R because we used unique sum-of-squares, shows that all of the variables were positively related to overall squad density. The betas may also be used as an attempt to assess the relative importance of the variables (Pedhazur, 1982) and suggest that squad progress scores contributed the most to group separation, followed by performance scores on the self-report subscale and flag duty scores, respectively.

Discussion

Conclusions regarding our first hypothesis, whether or not sociometry is a measure of cohesiveness, can be neither confirmed nor disconfirmed because of the poor internal consistency estimate of the team Unity scale with this study's sample. Because these items were not highly intercorrelated, the scale cannot be considered very homogeneous. The revised scale still did not produce a significant effect, leaving one to question either the validity of the scale with the sample used here or the assumed relationship by past authors of cohesion and sociometric density.

Beeber and Schmitt (1986) believe that cohesion is still a concept in search of a definition, and Murdack (1989) laments the legacy of confusion surrounding cohesion. Keyton and Springston (1990) warn that perceived similarity may not always align with perceptions of cohesion. Whether or not people make sociometric choices based on perceived similarity or for whatever reason is another study altogether, but it is reasonable to conclude that cohesion may not necessarily parallel sociometric choice.

Satisfaction, seen here as members' satisfaction or happiness to be a part of the squad, was found to be related to the sociometric density of the team. This is congruent with past results and makes intuitive sense. Members who are satisfied with their squad would be expected to pick more of their own current members if given the choice. One method for improving or maintaining a high satisfaction level among team members might be to let individuals have input into the makeup of their own teams, at the same time respecting those who should be involved in terms of job function. This could help to create a more contented team and perhaps a more effective work force for organizations.

These results are particularly relevant to companies using organizational structures like Total Quality Management (TQM), in which the focus is more on teams than on individual effort (Walton, 1986). Satisfaction, however, does not necessarily mean better results in terms of performance (Landy, 1989). Whether or not sociometrically dense teams are more effective in terms of higher performance could provide indirect evidence for this, however, which is what the final hypothesis test attempted to answer.

The last hypothesis was an attempt to establish a "bottom-line" result for industry. That is, can sociometry predict performance effectiveness in teams? Our results tend to support that conclusion and provide evidence that sociometry may prove to be a useful diagnostic tool for identifying how well a team may function on team-related tasks.

Although sociometry provided information on which teams would perform better in this study, it does not reveal much as to *why* some teams are more dense than others and subsequently perform better. This would be a profitable line of future research. Sociometry may provide a useful starting point for other forms of research investigating the causal agents of team effectiveness. Once the researcher knows that a team is more or less dense and can actually see with a sociometric diagram the pattern of interrelations in a group, he or she can then test other hypotheses.

For example, a team could achieve a high density score in part because the members all reciprocate choices with one particular member. If this is the case, then a deeper analysis, oriented around leadership theory, may be required. If the frequently chosen member of the group is also the formally appointed leader of the group, then an investigation into whether or not that person actually possesses some particular trait or is attributed certain qualities by the other members may be fruitful. If the frequency of choices a person receives differs according to a particular situation (e.g., who would you prefer to work with in a long-term project? short-term?), then perhaps further research in situational leadership theory is required.

Another case could be that certain patterns of sociometric choice moderate the effect of other variables or interventions; an example could be team-building exercises, which have received mixed reviews in terms of improving performance (Bettenhausen, 1991; Guzzo & Shea, 1992). Exercises that promote greater appreciation of other members' personality styles, for instance, may be effective only if there is a low frequency of reciprocal choices between members. Thus, sociometric pattern could act as a moderator of the effect that another variable, in this case, training, may have on the team's performance. Whatever variables the researcher is interested in, a sociometric diagram may provide a useful starting point for investigating causal agents of team effectiveness.

Future research using this method could support other uses for sociometry, such as personnel selection. Cognitive tests have generally proved to be the single most useful technique for staffing, but ability tests do not measure any relevant dimensions of the ability to work well with others. When an organization accomplishes its work by using teams, selection procedures may benefit from measuring the potential one has for working with others in a team, because this is now a relevant part of the performance domain. Who better to assess this potential than the members of the team(s) on which the applicant may be working?

Clearly, sociometry is more applicable as an internal-selection technique

with already existing employees, because a degree of familiarity is necessary for members to make choices among one another. Only intact teams were used in this research. Although this study could be viewed as a concurrent effort to confirm the effectiveness of sociometry as a predictor of an individual's success on a team, choosing individuals from outside the organization with no previous contact from team members is both awkward and dangerous without other types of information more common to traditional selection models (e.g., cognitive ability tests). Nevertheless, sociometry is still a useful diagnostic for both currently intact teams and for organizations with existing employees who wish to convert to a team-based structure.

Conclusions

Teams are becoming more and more popular as organizations continually strive to improve quality and compete globally. In this research we attempted to provide evidence of a new tool for diagnosing those teams and predicting a priori which ones would be more effective. Sociometry can be a valuable tool for organizations as their structures continually embrace the team concept of work.

This research has successfully shown that sociometrically dense teams are both more satisfied with their intrateam relations and more productive. Our results also showed that sociometric choice and cohesion may not necessarily be the same. Whether or not all of these findings are generalizable to other organizations remains to be seen, given the methodological idiosyncrasies encountered in this study. The nature of team research makes adequate sample sizes hard to obtain, necessitating adjustments such as more lenient alpha levels to improve power. Nevertheless, the most important finding of this study is that sociometrically dense teams are better performers on group- or team-related tasks. This finding alone is relevant to organizations embracing the team concept and should be seriously considered when work is structured for conditions that promote a team environment.

ACKNOWLEDGMENT

We are grateful for the assistance of Deanna Eberhardt and Amy Stewart in the data collection, and to Colonel Barclay, his staff and students, for allowing us the opportunity to conduct this research. Parts of this article were presented at the 1993 conference of the American Psychological Society in Chicago, IL.

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A Venezuelan Psycho-Opera: A Group and Individual Technique of Operatic Psychodrama

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ABSTRACT. The author presents Venezuelan psycho-opera's four forms of decreasing structure that foster an increasing capacity for spontaneity in participants. Drawing on a synthesis of Moreno's organic and instrumental forms of psychomusic, the author devised a technique that focuses on the exploration of the singing voice and the concomitant affects. The participants are accompanied by recorded collages of excerpts from orchestral music and follow a loose plot based on opera libretti or general and personal themes.

IN 1931, MORENO DEVELOPED an impromptu orchestra in New York and wrote about spontaneity in music improvisation; later, he expanded on these experimental ideas to include them in the process of psychotherapy in his technique entitled "Psycho-Music" (Moreno, 1946). Decades later, this latter work was translated into Spanish, as a separate publication (1948/1977).

By focusing on Moreno's overlooked contribution with music, I developed and tested in South America a technique originally entitled *Psico-Opera*, as a complementary tool for spontaneity training (Díaz de Chumaceiro, 1985). (Unaware that this term had been previously used in English by Wasserman and Klein in 1974, I renamed my more recent technique. These two complementary methods are contrasted in a final section.)

The new psycho-opera basically integrates Stanislavski's training for singer-actors and psychoanalytic assumptions with a synthesis of the two forms of Moreno's psychomusic: organic and instrumental. Gibberish (meaningless language) was used by Stanislavski (1936) to train actors and singer-actors (Stanislavski & Rumyantsev, 1975). Although Moreno (1946/1994) emphasized that "the theatre for Spontaneity has *no relation* to the so-called Stanislavski method" (italics added, p. 38), they do have in common the use