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ARE HUMAN FACTORS PEOPLE REALLY SO DIFFERENT?: COMPARISONS OF INTERPERSONAL BEHAVIOR AND IMPLICATIONS FOR DESIGN TEAMS

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Comparisons of Interpersonal Behavior and Implications for Design Teams

Abstract

This study examines differences between human factors and machine factors computer professionals in self-reports of their interpersonal behaviors. 311 computer professionals completed an instrument describing their jobs and three categories of their interpersonal behavior--Dominance, Friendliness and Task vs. Socio-Emotional. Human factors professionals described their ideal and actual behavior as more dominant than that of other computer professionals. No differences were found for the other two behavior dimensions. Human factors professionals on the average were more involved with research while machine-oriented professionals were more involved with product development. The findings are discussed with respect to their importance for computer system design teams. It is suggested that interpersonal factors may affect the utilization of human factors experts.

Without question the success of information systems (IS) depends on human factors. Over the years numerous writers have lamented that this truth was not self-evident to the system design community (Gaines & Shaw, 1986a; Hedberg & Mumford, 1975; Mumford, 1981; Norman, 1983; Peace & Easterby, 1973; Sackman, 1971). More recent work has, however, noted with optimism the increasing attention to human factors in the system design process (Madni, 1988; King, 1984; Christie, 1985). The best evidence that the importance of human factors is more and more recognized is the growing attention to involving end-users in system development (Boland, 1978; King, 1984; Robey & Farrow, 1982; Salaway, 1987; Robey, Farrow & Franz, 1989; Ives & Olson, 1984).

Ideally, system development teams will include members with human factors expertise (Gaines & Shaw, 1986b), but the human factors professional has traditionally not been viewed favorably by system designers. For example, Hammond, Jorgensen, MacLean, Barnard & Long (1983) interviewed designers and found that even in organizations where there was a human factors department, the designers rarely used it because they felt that human factors were unimportant or that the department did not offer real help. Gaines & Shaw (1986b) noted that human factors experts are seldom fully involved in system design. They compare human factors experts to medical specialists who "only get called in when there are problems."

There are nevertheless signs that the human factors expert is an increasingly welcome contributor to system design. King (1984) describes the current system design climate as one of increasing "dialogue between the users and DP." He says further that "[In] this type of environment, transfers of staff between DP and user organizations become attractive and productive" (p. 155). Thus the human factors expert who is an integral part of system design teams is becoming more common.

The current study asks the broad question, in what ways do the personal characteristics of human factors experts differ from those of machine factors experts and in what ways do these differences affect design team dynamics? The distinction between "human factors" and "machine factors" is based upon Christie's (1985) definition of human factors as "all the aspects of using a system that affect what users understand about the system, how they feel about the system, and how they behave in regard to the system" (p. 7). The machine factors expert, then, is someone whose work does not require direct concern with the user.

Much has been written about the characteristics of data processing (DP) professionals generally. Major topics have been their personalities (Couger & Zawacki, 1980; Bartol & Martin, 1982; Fitz-enz, 1978; Lyons, 1985; Shneiderman, 1980; Woodruff, 1980), their cognitive style (Huber, 1983; Robey, 1983; Kaiser, 1985; Keen, 1977; Keen & Bronsema, 1981), their values & attitudes (Mumford, 1981; White & Leifer, 1986), the factors that motivate them (Fitz-enz , 1978; Ferratt & Short, 1986, 1988; Goldstein & Rockart, 1984), and stress (Ivancevich, Napier & Wetherbe, 1983). Most of these studies have either compared DP to non-DP people or compared DP people across sub-specialties or ranks. None have specifically investigated human factors experts.

The important role that the mix of personal characteristics on design teams plays in group process has been demonstrated in past research. For example, Kaiser & Bostrom (1982) and White (1984) studied design team composition based on Jung's psychological types. Both studies found that teams with members of all types were more successful than were teams in which all types were not represented. On the other hand, differences in personality or cognitive style can lead to communication difficulties and conflict (Walz, Elam, Krasner & Curtis, 1987). The effect on system design success of the differences between end-users and designers has also been discussed (Zmud, 1979).

System development requires teamwork (King, 1984), and the majority of system developers' time is spent communicating with other people (Krasner, Curtis & Iscoe, 1987) White (1984) and White & Leifer (1986) found that machine factors experts, no less than other people, value good interpersonal relations on project teams. Thus, the current study focused on the interpersonal behaviors of machine factors and human factors experts. It was of interest to see how these two groups of people would differ in their patterns of behavior relevant to team work. More specifically, three dimensions of interpersonal behavior were emphasized: 1) Dominance, 2) Friendliness and 3) Task vs. socio-emotional. Research in the small group literature has pointed to the importance of these dimensions for work teams (Bales, 1970; Bales & Cohen, 1979; Polley, Hare & Stone, 1988). In the section that follows, each dimension is discussed separately and the study's hypotheses are presented.

Human Factors *vs.* Machine Factors

Who do human factors resemble most, other computer professionals (i.e. machine factors experts) or the end-users? If we consider the human factors expert to be the representative of the end user, then the same kinds of concerns for the relationship between end-users and designers that has been discussed in the user involvement literature can apply. It is generally thought that user involvement is necessary for system success, but the empirical evidence has been mixed (Ives & Olson, 1984). The benefits of involving users in the design process depends on managing effectively the communication and interpersonal relationships with designers (DeBrabander & Edstrom, 1977; DeBrabander & Thiers, 1984; Swanson, 1974; Zmud, 1979). Similarly, the effects on team dynamics of possible differences between human- and machine-factors experts need to be well managed.

We might expect human factors experts to differ from machine factors experts because of an important difference in their backgrounds. Human factors specialists typically do not receive their training in computer science, but rather are trained in psychology and related disciplines. Moreover, people with backgrounds in computer science, particularly at the undergraduate level, typically get little exposure to human factors as part of their education. For example, Booth, Brobaker, Cain, Danielson, Hoelzeman, Langdon, Soldan & Varanasi (1986) in describing what topics a curriculum in computer design should contain, mention very briefly "social impact" as an integral part of the design process. Gibbs & Tucker (1986) present a model curriculum for a liberal arts degree in computer science which does not mention any subjects that could be construed easily as incorporating human factors principles. Peter Keen's work has shown that differences in professional discipline and training are related to differences in cognitive style (e.g. Keen, 1977). These background differences are likely to be related to other characteristics as well. In particular, it is hypothesized here that these differences will also be related to differences in interpersonal behaviors along the dimensions of dominance, friendliness and task *vs.* socio-emotional. Each dimension is discussed separately below.

Dominance. The behaviors captured by this dimension are related to participation and introversion-extroversion. In group interactions dominant people are active and talkative. Robey & Farrow (1982) and Robey, Farrow & Franz (1989) have demonstrated the relevance of this behavioral dimension for conflict and conflict resolution in system development teams. They note that conflict *per se* is not negative, but rather ineffective management of conflict is. Using data gathered from a major system development project they showed that participation and influence had a positive effect on conflict resolution. That is, the people who were more dominant and influential were better able to help in resolving group conflicts.

King (1984) presents further arguments for the importance of dominance and influence in system development teams. The so-called "egoless" programming teams--teams with no formal leader--have been effective in very few cases. According to King, without someone to provide direction, the teams lack motivation and "drift aimlessly if a natural leader does not emerge, and in most cases one does not. Thus, the ability to exert influence and leadership--dominant behavior--is an important interpersonal skill.

Shneiderman (1980) also notes that "the assertive individual who is...not intimidated easily...is often seen as the superior programmer type" (p. 55).

Based upon the difference in training of human and machine factors experts we would expect the human factors expert to exhibit more dominant behavior than machine factors experts. Goldstein & Rockart (1984), for example, note that the training of programmer/analysts typically does not include leadership skills. King (1984) also notes that most computer science curricula do not teach people how to be team players. The following hypothesis will thus be tested:

H1: Human factors experts exhibit more dominant behavior than machine factors experts.

Friendliness. This dimension comprises behaviors that are positive, other-oriented, equalitarian and cooperative vs. behaviors that are negative, individualistic and uncooperative. The small group and organization literature generally and the system development literature more specifically shows this dimension to be important for project group effectiveness. Behaviors along this dimension can have an impact on work motivation, as shown by need theories of motivation. Needs for affiliation, acceptance and inclusion are important motivators (Maslow, 1970; Alderfer, 1972; McClelland, 1971) for some people, and quality of interpersonal relations with co-workers and supervisors is a factor that contributes to job satisfaction (Herzberg, Mausner & Snyderman, 1959; White & Leifer, 1986).

Although some evidence exists that computer professionals have lower social needs than the average population (Bartol & Martin, 1982), the stereotype of the misanthropic programmer has not been consistently supported by the literature (Ferratt & Short, 1986, 1988, 1990; Im & Hartman, 1990). Ferratt & Short (1988) have argued that the motivational patterns of DP professionals do not differ from the patterns of other people, once organizational level is taken into account.

In a study of job satisfaction among system professionals, Goldstein & Rockart (1984) report that supervisor support (e.g. extent to which supervisor is friendly and easy to approach) correlated significantly with job satisfaction. Shneiderman suggests that "a friendly, warm, cooperative style will be helpful in team programming... ." And Mantei (1981; 1990, personal communication), in discussing structured programming teams, suggests that friendliness is important for relations with clients.

In light of the changes occurring in the computer profession since the publication of Bartol & Martin's (1982) review, we are likely to see machine factors experts who are more sensitive to other people than in the past. The study will thus test the following hypothesis:

H2: There is no difference between human factors experts and machine factors experts in friendly behaviors.

Task vs. Socio-Emotional. This dimension refers to behaviors that are controlled, serious and task-oriented vs. behaviors that are expressive, light-hearted and emotional. This dimension captures the classic distinction between task vs. socio-emotional behaviors from the small group literature (Bales, 1958). This dimension also correlates with the thinking-feeling dimension in the Jungian typology (Polley, Hare & Stone, 1988), used frequently in the system development literature. The preference for a thinking approach to decision making--using impersonal bases for making decisions--does not mean these individuals do not experience deep emotions. Rather it means that they are not likely to be as demonstrative as a feeling type--one who prefers to use personal criteria for making decisions (Kiersey & Bates, 1978). Groups need both types of behavior in order to be effective.

Two studies in particular support the need for balance between task and socio-emotional types. Kaiser & Bostrom (1982) and White (1984) both found that teams with all thinking and no feeling types were less effective than were teams that had both types represented. Kaiser & Srinivasan (1982) and Kaiser (1985) present data suggesting that the proportion of feeling types among computer personnel is lower than in the general population. Research on the distribution of Jungian types suggests that in technical fields such as computer programming, accounting and engineering contain fewer feeling than thinking types even though there are equal proportions of these two types in the general population (Kiersey & Bates, 1978). Comparing human factors experts to machine factors would lead to the prediction that machine factors experts are less emotionally expressive than human factors experts. This study thus tests the following hypothesis:

H3: Human factors experts are more emotionally expressive than are machine factors experts.

Job Characteristics

The work of Ferratt & Short (1986, 1988) has demonstrated the importance of taking job context into account in studies of the characteristics of computer professionals. The current study also examined differences between human factors and machine factors experts in characteristics of their jobs. Four characteristics were studied. First was the actual extent to which human and machine factors experts regularly worked as part of a team.

Second was the degree of management responsibility held. Many writers have criticized the data processing profession for failing to train people sufficiently in managerial skills (e.g. Shneiderman, 1980). Goldstein & Rockart (1984) call for increased attention to developing the DP person's managerial skills. King (1984) blames the failure of egoless programming teams on the lack of management and leadership skills in the general programmer population. The alternative--chief programmer teams--are often ineffective because the "superstar" programmers with the technical and interpersonal skills are rare.

The degree to which human factors experts were regular members of teams that produced actual system products was the third characteristic. The human factors expert has traditionally resided in a department separate from actual system development (Hammond, 1983; Krasner, Curtis, & Iscoe, 1987), and are not always viewed favorably by designers (Hammond et al., 1983). To what extent does this pattern continue to be reflected in the current sample? Fourthly it was of interest to study whether the human factors experts were more likely than machine factors to be involved in research, unconnected to product development.

The following four hypotheses, regarding job characteristics were tested in addition to the behavioral hypotheses:

H4: Human factors experts will be less likely to work regularly as part of a team than machine factors experts.

H5: Human factors experts will be less likely to be involved in product development than machine factors experts.

H6: Human factors experts will be less likely to be involved in product development than machine factors experts.

H7: Human factors experts will be more likely to be involved in research than machine factors experts.

Method

Participants

The sample was generated from the mailing list of participants in the tutorials at the CHI'85 (Computer-Human Interface) conference. The tutorials at this annual conference allow attendees to participate in introductory and advanced short courses in topics such as user-computer interface design. The majority of the people on the list were professionals working in industry. Questionnaires and a cover letter were mailed to everyone on the list except those at academic institutions or with addresses outside North America. Five hundred thirty questionnaires were mailed, and 311 usable ones were returned--a 59% response rate.

This sample is obviously not random nor fully representative of the computer profession. The fact that they attended this conference, and especially that they participated in the tutorials, suggests that they had some interest in human factors, whether or not they were specialists. However, such a bias in the sample would tend to decrease the chances of supporting the study's hypotheses because the machine factors experts would be more like human factors experts than we would normally expect. Appropriate care will be taken in interpreting the data.

Questionnaires

Job Descriptions

Respondents provided in their own words brief descriptions of their jobs. Using these descriptions, the author and a colleague who is an expert in computer system design independently classified each respondent as human factors or machine factors. The following operational definitions guided the coding:

> Human Factors
> The work focuses either exclusively on humans or on the human side of the human-computer interface. People who study cognitive processes or human adaptation to systems, for example, were placed here. Some systems analysts, depending upon the specifics of the descriptions they gave, would also be placed here.
>
> Machine Factors
> The work focuses either exclusively on machines or on the machine side of the human-computer interface. Programmers and hardware engineers were placed in this category, for example. Also placed here were people who developed interface software or hardware.

There were a number of respondents whose jobs fit neither of these categories. These were jobs involving documentation or graphic arts, for example. These people were coded as "other." There was a 74% level of agreement between the two coders on the initial classification. Disagreements were resolved through discussion for the final categorization.

In addition to these job descriptions, the respondents provided some specific information about their jobs. They indicated whether or not they worked regularly as part of a team (coded as a 0, 1 variable). They were also asked to rate, on 5-point Likert scales (where 1=very little and 5=a great deal), the extent to which their jobs involved managerial responsibility, research and product development.

Other data gathered were age, gender, salary range, level of education and field of education. Education field was coded into nine categories: Information Systems and Computer Science, Psychology, Other Social Science, Physical Science, Law & Humanities, Business, Education, Art and Other.

Interpersonal Behavior

The dependent variables in the study were self reports of interpersonal behavior. These measures were adapted from SYMLOG (Bales & Cohen, 1979). The three dimensions--Dominance, Friendliness and Task vs. Socio-Emotional--are bi-polar and orthogonal, and were derived through a series of factor analytic studies (Bales & Cohen, 1979; Bales & Couch, 1969). Figure 1 presents the three dimensions graphically.

The work of Bales has been noteworthy for its stress on the influence of personality on interpersonal processes (Bales, 1970; Bales & Cohen, 1979). SYMLOG was chosen for this study because of its emphasis on interpersonal behavior. It is a flexible system (McGrath, 1984) that has been used to address a variety of research topics (Polley, Hare & Stone, 1988) ranging from social cognitive structure (Isenberg, 1986), to leadership (Bales & Isenberg, 1982), to political judgments (Polley, 1983).

The system's validity and reliability have been established through a number of studies. Bales & Cohen (1979) report reliability coefficients, based on Gulliksen's (1950) formula, of 0.77 for the dominance-submissiveness dimensions, 0.95 for the friendliness-unfriendliness dimension and 0.80 for the task vs. socio-emotional dimension. Isenberg & Ennis (1981) demonstrated that the SYMLOG dimensions, based on factor analysis, were consistent with dimensions derived through multidimensional scaling. Isenberg (1986), found cross-domain and temporal stability in subjects' perceptions of the SYMLOG dimensions. Fassheber & Terjung (1985) found SYMLOG to be predictive of behaviors outside of a group context.

All possible unique combinations of the poles of the three dimensions result in 26[1] specific behavior descriptions, shown in Figure 2. Ratings of stimuli are made on the specific descriptions and then combined arithmetically to yield single scores for each of the three dimensions (Bales & Cohen, 1979). For example the first nine items on the list in Figure 2 measure dominant behaviors, and the last nine items on the list measure submissive behaviors. The sum of the ratings on the submissive items is subtracted from the sum of the ratings on dominant items to yield a single score for the Dominance dimension. Scores with a positive sign represent dominant behavior, and scores with a negative sign represent submissive behavior. In the present study, the ratings on each of the 26 items were made on three-point scales where 0=not often, 1=sometimes and 2=often.[2] Thus the scores on each dimension could range from -18 to +18. The calculations would be the same for the other two dimensions.

The respondents in this study rated, for each of the behavioral descriptions shown in Figure 2, the extent to which they actually behaved in each of these ways, and the extent to which they wished to behave in each of these ways. They were not asked to specify any particular circumstances in making these ratings, but rather were asked to describe their behavior in general. For each of these three stimuli, the scores were calculated on each of the three dimensions, resulting in nine scores for each respondent. These scores were the dependent variables of the study.

Results

Description of the Sample

Sixty-four percent of the respondents were male, and the mean age was 34. The bulk of them (78%) earned annual salaries between $20,000 and $50,000. Ninety-seven percent of them had at least a bachelor's degree, twenty-six percent had doctorates and thirty-three percent had master's degrees.

The machine-oriented groups made up the single largest percentage of the sample overall (50.8%), and as expected, the majority of them had degrees in information systems or computer science (84.3%). Approximately seventy-three percent (72.6%) of the human-oriented respondents had degrees in Psychology. It is also noteworthy that the bulk of the respondents who held doctorates were in the psychology field (58.1%), and in the human factors category (52.6%).

The respondents' jobs on the average involved little management responsibility (M=2.41, SD=1.19). Most of them were involved to a moderate extent with product development (M=3.66, SD=1.43), while very few were involved with research (M=1.74, SD=0.91). Approximately half (53.3%) reported that they worked regularly as part of a team.

Interpersonal Behavior

In order to test Hypotheses 1 to 3, one-way analyses of variance were conducted for each of the dependent variables, with planned comparisons to test for specific differences between the human factors and machine factors groups (Rosenthal & Rubin, 1984).

Table 1 presents the means on each of the dimensions for wished-for and actual behaviors. The planned comparisons showed clear differences between the human-and machine-factors groups on the Dominance dimension. The human-oriented groups reported that they wished to behave more dominantly than the machine-oriented groups reported, $F(1,308)=10.66$, $p=.001$, $r=0.18$.[3] Further, the respondents who were human-oriented reported that their actual behavior was more dominant than reported the machine-oriented groups, $F(1,308)=5.68$, $p=0.038$, $r=0.13$. These findings support hypothesis H1. As predicted, there were no differences on the Friendliness dimension, supporting H2. Contrary to the prediction of H3, no differences on the Task vs. Socio-emotional dimension were found.

Job characterstics

There was a greater tendency for machine factors experts than human factors experts to be members of regular teams: 60% machine factors; 43% human factors, but this trend did not reach conventional levels of significance $\underline{X}^2(4)=8.82$, $\underline{p}=.07$. Thus, Hypothesis 4 is only marginally supported. One-way ANOVAs were conducted with extent of managerial responsibility, involvement with product development and involvement with research as the dependent variables, and planned comparisons to test the specific difference between human-oriented and machine-oriented groups.

Table 2 presents the means for these variables and the ANOVA results. The analyses showed no significant effects with respect to level of managerial responsibility. Hypothesis 5 was therefore not supported. There were significant main effects for the extent of involvement with product development and research. The planned comparisons showed higher involvement in product development among the machine oriented groups than among the human-oriented groups $\underline{F}(1,308)=11.14$, $\underline{p}=.0009$, $\underline{r}=0.19$; human-oriented groups reported more involvement in research than did machine-oriented groups, $\underline{F}(1,308)=4.61$, $\underline{p}=.03$, $\underline{r}=0.12$. Thus, hypotheses H6 and H7 were strongly supported.

There was a significant interaction effect between specialization and team membership. Human factors specialists were not likely to be involved with product development if they were on a team, while machine factors specialists were likely to be involved in product development if they were on a team. There was no interaction for involvement with research.

Discussion

This study found that, as predicted, human-factors experts were likely to behave more dominantly than machine factors experts, and were equally likely to behave in a friendly way, based on self reports. No differences on emotionally expressive behavior appeared. There was a slight tendency for machine factors experts, more than human factors experts, to work on a team consistent, with the hypothesis. Human factors people were more likely to be involved in research and less likely to be involved with product development than machine factors people.

At least with respect to perceptions of their own behavior, human factors experts are more like the general population (i.e. the end user) than they are like their machine factors colleagues in dominant behavior. On the other hand, the human and machine factors people were similar in their reported Friendly and Expressive behaviors. Both groups saw their actual behaviors as friendly and task oriented, and wished to behave more friendly. Although the similarity on the Friendly dimension was predicted, the similarity between these two groups could also partly be a function of sampling bias. The machine factors people who attend CHI conferences may actually behave more like human factors people than other machine factors people. Nevertheless these findings are consistent with those of other researchers that computer professionals value friendly, cooperative behaviors on work teams as much as other people (White & Leifer, 1986; Ferratt & Short, 1986).

Although there has been a trend toward increased incorporation of human factors experts into the entire system design process, the data from this study indicate that human factors are still unlikely to be regular members of teams working on product development. Most of these respondents worked on research. This finding too could be related to sampling bias. The people who attend conferences might be more involved in research, but these data show that the sample in general reported that they did little research. Thus, sampling bias cannot explain this finding very well. More likely, the human factors expert plays a consultative and support role to product development teams.

Limitations of the Study

Most obvious is the bias of the sample. Clear explanations of the findings are difficult to formulate, and the generalizability of the findings is limited.

A second limitation is that all the data were self report. Bales & Cohen (1979) report that respondents tend to rate themselves as less dominant and more friendly than others would rate them. This is due to differences in perception, and the stimuli in the environment selected for attention, as suggested by attribution theory (Jones & Nisbett, 1972). Observers would tend to see others as more Dominant because of the saliency of dominant behavior. Self-serving biases lead people to see themselves as more friendly and positive than others see them. We would not expect the biases to affect this study's results regarding the differences between human and machine factors people, but must be considered when comparing these findings to those of other studies.

A third limitation is related to the framing of the SYMLOG questions. The respondents were requested to describe their behavior in general, rather than in a specific setting. Since behavior is partially situationally determined (Mischel, 1984), measurement validity could be increased by asking people to describe their behavior in context. It is possible that the respondents did consider their work setting as the context, but we cannot be sure. We thus have to assume that a larger than desirable amount of error variance exists in the behavioral measures.

Implications and Conclusions

Despite the study's limitations, there are several important implications. First, the study suggests that human factors experts are different from machine factors experts, but not that different. This is good news and bad news. The good news is that if human factors people are not so very different from other computer professionals, then communication and interpersonal dynamics on project teams will be smoother than if otherwise. However, as the work of Kaiser & Bostrom (1982) and White (1984) has shown, having a variety of personality types represented on teams is associated with higher quality outcomes. So that potentially is the bad news. If human factors people are pretty much like machine factors people, then project teams gain little in diversity.

We should take a careful look at the utilization of human factors people in computer system design. If the trend toward increasing end-user involvement continues what then will be the role of the human factors expert? It appears that in some respects dynamics between human factors and machine factors resemble those between end-users and systems people generally. If human factors experts become integral members of design project teams, then it would be important to understand their potential impact on group process.

Huber (1983) has questioned the value of studying individual characteristics such as cognitive style in MIS. Although his criticism was leveled at the attempt to design systems that are compatible with users' style, it has some relevance to this study. What is the value of knowing that human factors and machine factors people may or may not differ in their interpersonal behaviors? In a reply to Huber, Robey (1983) agreed that there is a certain futility in trying to match systems to users' style, but argued for assessing the cognitive style of designers for the sake of project team development. Research in information systems and in small groups more generally has demonstrated the significant effect of team composition and member characteristics for effectiveness (Kaiser & Bostrom, 1982; White, 1984; Hackman, 1987; Bales, 1970). By knowing something about the mix of personalities on a system development team, the leader or facilitator can make better decisions about how to manage that team.

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Notes

[1] Although there are 27 possible combinations of the three dimensions, there are only 26 adjectival descriptions because one of the combinations is the null set.

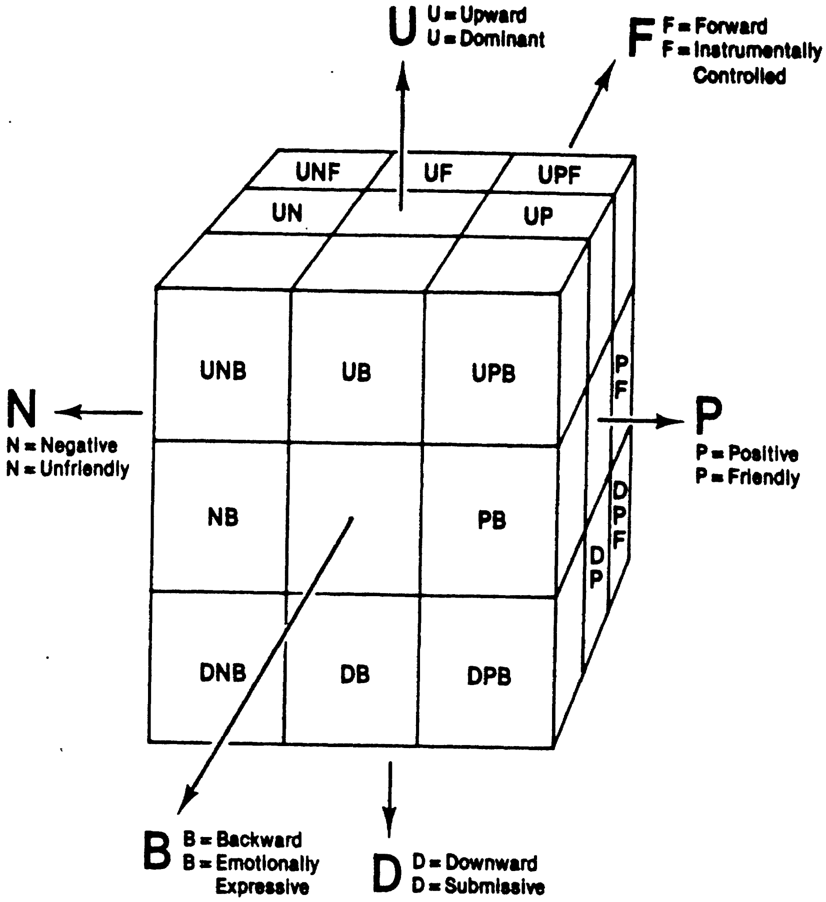
[2] The ratings could also be made on 5 point scales. The results on 5 point and 3 point scales do not differ significantly from each other (Bales & Cohen, 1979).

[3] The effect size, *r*, is computed with the following formula:

$$\sqrt{\frac{\text{F x df numerator}}{\text{F + df denominator}}}$$

For df > 1 *r*=*eta* (Rosenthal & Rubin, 1984).

FIGURE 1 The SYMLOG Three-Dimensional Space



The SYMLOG Three-Dimensional Space, Showing Classes of Directions, or Locations, Defined by Logical Combinations of the Six Named Reference Directions. (The cube is seen from an outside point. The Directions are named from a reference point at the intersection of the three dimensions, looking Forward.)

Figure 2 SYMLOG Adjectives and Rating Scale

SYMLOG

General Behavior Descriptions

Your name ______________________ Group ______________

Name of person described ______________________ Circle the best choice for each item:

		(0)	(1)	(2)
U	active, dominant, talks a lot	not often	sometimes	often
UP	extroverted, outgoing, positive	not often	sometimes	often
UPF	a purposeful democratic task leader	not often	sometimes	often
UF	an assertive business-like manager	not often	sometimes	often
UNF	authoritarian, controlling, disapproving	not often	sometimes	often
UN	domineering, tough-minded, powerful	not often	sometimes	often
UNB	provocative, egocentric, shows off	not often	sometimes	often
UB	jokes around, expressive, dramatic	not often	sometimes	often
UPB	entertaining, sociable, smiling, warm	not often	sometimes	often
P	friendly, equalitarian	not often	sometimes	often
PF	works cooperatively with others	not often	sometimes	often
F	analytical, task-oriented, problem-solving	not often	sometimes	often
NF	legalistic, has to be right	not often	sometimes	often
N	unfriendly, negativistic	not often	sometimes	often
NB	irritable, cynical, won't cooperate	not often	sometimes	often
B	shows feelings and emotions	not often	sometimes	often
PB	affectionate, likeable, fun to be with	not often	sometimes	often
DP	looks up to others, appreciative, trustful	not often	sometimes	often
DPF	gentle, willing to accept responsibility	not often	sometimes	often
DF	obedient, works submissively	not often	sometimes	often
DNF	self-punishing, works too hard	not often	sometimes	often
DN	depressed, sad, resentful, rejecting	not often	sometimes	often
DNB	alienated, quits, withdraws	not often	sometimes	often
DB	afraid to try, doubts own ability	not often	sometimes	often
DPB	quietly happy just to be with others	not often	sometimes	often
D	passive, introverted, says little	not often	sometimes	often

Table 1 Mean Responses on Behavior Dimensions [a]

	Job Category		
Behavior rating	Human	Machine	Other
DOMINANCE			
Wished for	4.59	3.41	3.44
	(2.75)	(2.81)	(2.89) [b]
Actual	2.02	0.82	1.35
	(3.97)	(4.00)	(3.69)
FRIENDLINESS			
Wished for	11.99	12.13	11.68
	(2.79)	(3.13)	(3.61)
Actual	8.14	7.47	7.44
	(3.79)	(4.07)	(5.26)
EXPRESSIVENESS			
Wished for	3.43	3.15	3.44
	(2.40)	(2.65)	(3.01)
Actual	2.24	2.17	3.17
	(3.31)	(3.52)	(4.12)
N	99	158	54

---

[a] The scale ranges from -18.0 to 18.0.

[b] Standard deviations are in parentheses.

Table 2 Mean Job Characteristics by Job Catetory

	Job Category			
Characteristic	Human	Machine	Other	*F*
Mgmt responsibility	2.31 (1.11)[a]	2.39 (1.16)	2.59 (1.45)	0.26
Product development	3.37 (1.54)	3.97 (1.29)	3.20 (1.47)	11.14**
Research	1.89 (1.18)	1.63 (0.76)	1.76 (1.18)	4.61*
N	99	158	54	

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[a] Standard deviations are in parentheses

* p < .05
** p < .001