DOCUMENT RESUME

ED 190 131 IR 008 625

AUTHOR	Callahan, Daniel; And Others
TITLE	Up the Pyramid! Application of a Multi-Dimensional Model for STI Behavior Research.
INSTITUTION	Applied Communication Research, Inc., Palo Alto, Calif.
SPONS AGENCY	National Science Foundation, Washington, D.C. Div. of Information Science and Technology.
PUB DATE	May 80
GRANT	IST78-10531
NOTE	21p.: Paper presented at the American Society for Information Science Mid-Year Meeting (Pittsburgh, PA, May 15-17, 1980).
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Behavioral Science Research; Engineers; Information Systems; *Information Theory; *Models; Scientists; *Systems Approach
IDENTIFIERS	*Information Behavior Research; *Scientific and Technical Information

ABSTRACT

This study demonstrates the systems approach to scientific and technical information behavior research through the application of a multidimensional model to data concerning the effects of higher level variables on professional job types. The model was first developed in a study examining organizational barriers to the flow of STI in organizations. The study collects data on the information-related attitudes and behavior of more than 500 scientists working in a variety of organizations. Secondary analysis of these data culminates with the development and testing of the systems model. Discriminant analysis methodology is applied to the findings and nine variables are found to best account for variance among six job types. Profiles of job types are developed according to relative rankings of the predictive variables. A classification scheme is then developed which groups them along print, verbal, and STI dimensions. Graphing of the scores of the job types on the predictors results in a guide for assessing the degree of similarity among job types. (Author/RAA)

UP THE PYRAMID!

APPLICATION OF A MULTI-DIMENSIONAL MODEL FOR STI BEHAVIOR RESEARCH

Daniel Callahan

Georg Lindsey

Colin Mick

Applied Communication Research, Inc.

Palo Alto, California

This report is based on research supported by the Division of Information Science and Technology of the National Science Foundation under Grant Number IST78-10531. Opinions, findings, conclusions and recommendations contained in this report are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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Daniel Callahan, Georg Lindsey and Colin Mick
Applied Communication Research, Inc.
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The idea of a systems approach to information behavior research is discussed. As an example of this approach, a model is presented which identifies several levels of external determinants of STI (Scientific and Technical Information) behavior. This model is applied to the data from which it originated, through the investigation of the effects of higher level variables on job types.

A brief summary is presented of the research which led to the development of a multi-dimensional model for information behavior research. The model was first developed in a study examining organizational barriers to the flow of STI in organizations. The study collected data on information-related attitudes and behaviors of more than 500 scientists and engineers working in a variety of organizations. Secondary analysis of this data culminated with the development and testing of the systems model.

The discriminant analysis methodology used to apply the findings of this model is discussed. Nine variables are found to best account for the variance among six job types. These variables are identified and described. Profiles of job types, developed according to relative rankings on these predictive variables, are also discussed.

A classification scheme is developed for the predictive variables which groups them along print, verbal and STI dimensions. A graphing of the scores of the job types on the predictors is used as a guide for assessing the degree of similarity among the job types.

The study demonstrates one application of the model and the research paradigm discussed in the introductory section.

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I. INTRODUCTION

It has been argued (see Mick, et al., 1979) that a more thorough understanding of social networks (e.g., organizational, communications, information) can be had by investigation which proceeds along lines developed by systems theorists (e.g., Ackoff, 1974). While systems approaches to social inquiry are not new--Aristotle may have been one of the first to espouse such an approach--neither have they been readily employed, especially vis-a-vis the field of information science. Lindsey's (1979) work developed and applied just such a systems analysis in a study of the information behavior of scientists and engineers in both the public and private sectors. One result from this study was the STI (Scientific and Technical Information) research model, reproduced as Figure 1.

Inspecting this figure, one can see that research into STI behavior can take place (indeed should take place) in both horizontal and vertical dimensions. Research at levels higher than that of "individual variation" will engender findings which will at once reveal less about any particular level and more about the system under study. For example, research into institutional differences in STI behavior will reveal little about individual variation *per se*, yet will tell us much about the effects that institutions may ultimately have on the behavior of individuals.

What is also implicit in this conceptualization of STI behavior is that at each level variables both influence all variables at levels below them and are influenced by variables at all levels above them. Thus, work environments (Level 4) will affect job types (Level 3), individual tasks (Level 2), and individual variation (Level 1). At the same time work environments are affected by organizations (Level 5), institutions (Level 6), social structures (Level 7), cultural characteristics (Level 8), and those levels (here left unenumerated) which supersede cultures.

In the study of Euclidian geometry (Considine, 1976) one successively explores the behavior of lines, of planes and finally of solids. Analysis occurs in one, then two, then three dimensions; each dimensional analysis assimilates that which preceded it and becomes assimilated by that which follows it. The paradigm of STI behavior research discussed above can be seen to have similar characterstics(*): each level of research can be seen as the exploration of another dimension, an exploration which supersedes that which preceded it. Alternatively, one can think of research into one individual's behavior as "linear", inquiry regarding a collection of individuals as "planar", and research into any/all of the

* If time is accepted as a fourth dimension, then the analogy can be extended to include the conduct of time-series studies.

levels above that of individual variation as "spheroid", "cubic", etc.

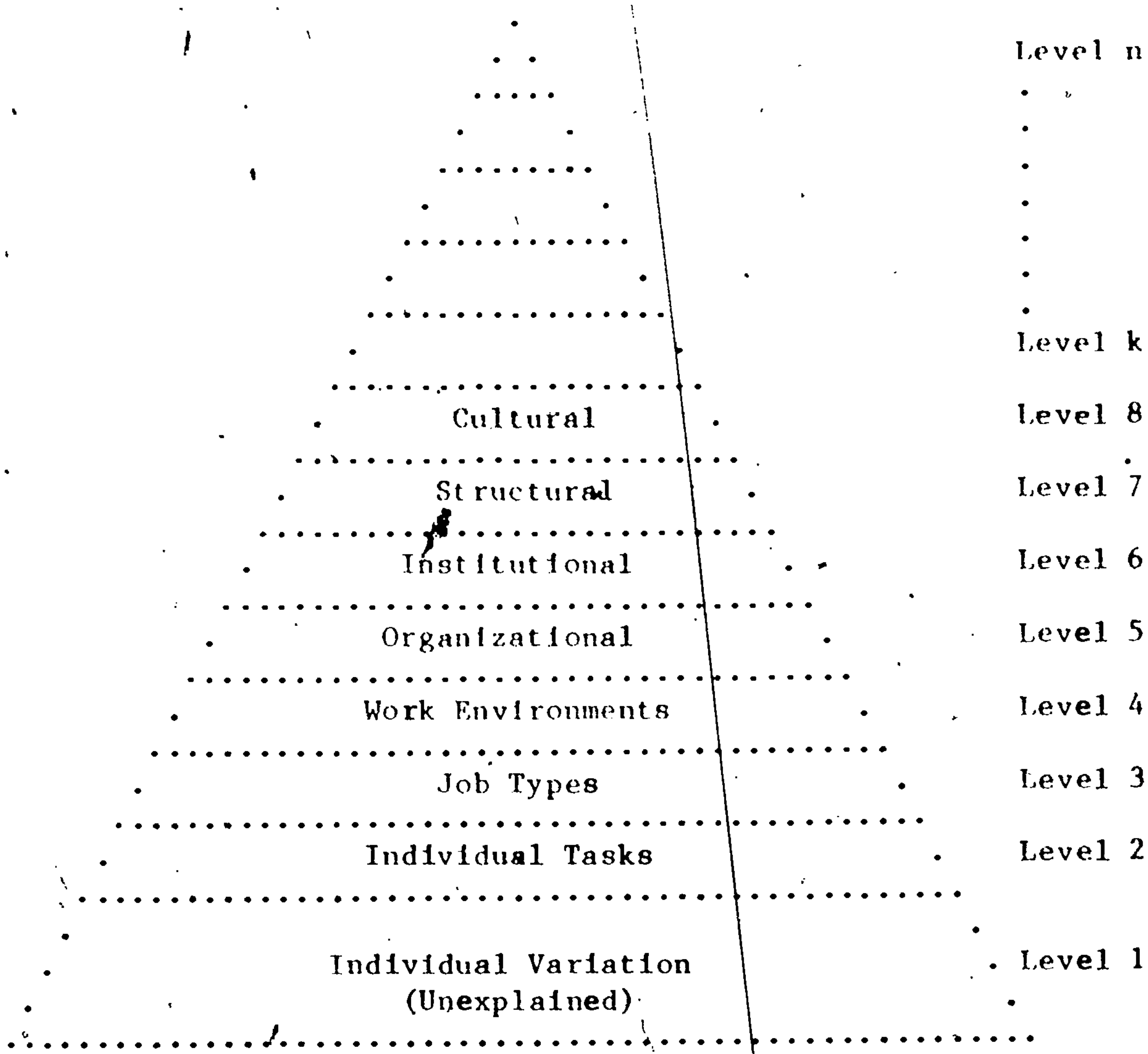

Figure 1. Explained STI behavior as represented by area under triangle showing different levels of abstraction and/or levels of research. Bottom is lowest abstraction and highest cost, upper is greater degree of abstraction and lower cost.

Source: Lindsey, 1979.

This paper represents an attempt to conduct an analysis according to the paradigm previously specified. Level 3, "Job Types" is considered in terms of those variables at higher levels which may be affecting it and in terms of the effects it has on variables at those levels below it. This plan can be specified as an identification of the variables which "predict" or are associated with particular job types and investigation into the characteristics of job types as a means of assessing their influence on individual tasks and individual behavior variation.

The purpose of providing profiles of job categories according to certain variables is heuristic: one can examine the variables developed as predictors, identify and discover the nature of non-intuitive predictive variables, and measure the extent to which they perform their function.

Thus, this paper can serve as a complement to an analysis of variance of the domain of variables by job type.

The idea of developing profiles of job types grew out of analysis aimed at discovering the existence and/or extent of influence which the variable "Job" had on the other variables, and especially the effect it had relative to that which might be present for the variable "Division".

Four sections follow. The first section briefly covers the research on which the present study was based. The second section briefly covers the methodology employed in determining the predictors of job type. The third section describes each job classification according to its relative ranking on the predictive variables. The fourth section discusses observations to be made with regards to the analysis and its consequent results.

II. RESEARCH FOUNDATION

The data on which this study is based were collected by Gellman Research Associates, the Bendix Corporation and Applied Communication Research, Inc. under an NSF-sponsored study to explore organizational barriers to the flow of scientific and technical information. The data base consists of responses by some 500 respondents (engineers and scientists at varying levels of management responsibility, employed by the Bendix Corporation) to a sixteen-page questionnaire containing more than 600 variables.

The development of the questionnaire is described in detail in a report by Gellman Research Associates (1979). The questionnaire was based on a model of individual information behavior that represented an attempt to distill what was known about the factors affecting individual information behavior into a form that would help guide a more policy-oriented approach to user studies. It included the explication of a number of terms used to describe factors affecting information behavior, a model of individual information behavior, and an attempt to develop a model that would place these individual behaviors within the context of task, role, functional, and organizational factors.

A detailed questionnaire based on this framework was developed. The questionnaire was designed to get a total picture of all factors affecting the information behaviors of individuals in an organizational setting. The questionnaire focused on five areas: individual demographics (including position in the organizational hierarchy), attitudes concerning information, perception of management attitudes towards information behavior, individual information behaviors and practices, and attitudes towards specific attributes of information products and services.

The questionnaire was first used in the Bendix/GRA/ACR study. In this study it was distributed to a sample of some 1,000 scientists and engineers working in 19 Bendix divisions in May, 1977. The response rate to the questionnaire was approximately 52 percent, and a total of 502 usable questionnaires were obtained. Initial analysis of these questionnaires is reported in Mick and Feinman (1977), Mick (1979) and Gellman Research Associates (1979).

Secondary analysis of the data was conducted by the authors in three stages. First a descriptive set of indices for each of four areas (i.e., attitude structure, information orientation, task orientation, information attributes) was developed. Next, relationships of the variables within these indices as well as relationships to indices developed in the other areas were then examined. Relationships among the indices and the demographic variables were explored as well. A multi-variate (regression) approach was used to examine pattern complexes, and a model was developed to gain insight into the network of relationships among the variables. Finally, the model was tested against data (collected via the original questionnaire) from scientists and engineers working in mission-oriented research laboratories.

The theoretical intent of the study was to move organizational analysis away from the pursuit of "individual difference theory", and in the direction of more insight into the methods by which complex systems/organizations could be understood.

III. METHODOLOGY

This investigation into the predictors of job type was made using discriminant analysis--the SPSS subprogram "Discriminant". This procedure takes in variables to be used as predictive variables and measures their ability to predict occurrences of values for some dependent variable (in this instance, "Job"). The program selects variables as predictors according to how well they explain the variation among observed values for the dependent variable. Having developed a set of predictive variables from the original pool of possible predictors, the program then evaluates those variables for their "fit" with the data; i.e., how well they predict the actual occurrence of values for the dependent variable.

All variables were originally to be included as possible predictors; however, this procedure had to be amended due to the nature of the "Discriminant" subprogram. Inclusion of all variables as possible predictors of job type would have led to development of uninteresting predictors (e.g., Time in Management and Administration as a predictor for Manager) at the expense of reduced statistical power (due to an unavoidable reduction in the number of cases under analysis). To increase the utility and statistical significance of any results, the demographic variables were removed from consideration, as were those variables which had been shown on previous runs of the subprogram to fail as predictors of job type. The information attribute variables which did not measure frequency of use were also deleted from the domain of possible predictors. The high degree of correlation among "frequency" and non-"frequency" information attribute variables supported the decision to allow only one variable (as a representative of similar variables) to enter into the analysis. Through these manipulations a total of 283 cases (out of 502) were considered in the analysis, increasing the reliabilty of any significant results which might follow.

The variables which were determined to be predictors of job type were found to predict 40.27% of the "variance" for the variable "Job". The variables are listed in the following section. Descriptions of the variables can be found in Lindsey, 1979. Figure 2 presents the variables and their mean scores for each of the values of "Job".

	Mngr	Proj Ldr	Prod Eng	Des Eng
	1	2	3	4
HRSSTI	16.9483	16.7333	10.2083	11.4228
RRF	2.6294	2.6195	2.2538	2.4643
TAF	3.4251	3.4557	3.0806	3.3351
TIMESHD	27.2500	31.9919	26.4583	27.9474
SPF	2.3874	2.6181	2.3792	2.5745
IVF	3.2975	3.0861	2.9471	2.8885
EIS	2.7103	2.5360	3.0417	2.6402
IMIE	non-significant variation			
SORALIN	non-significant variation			
SPO	11.2361	13.4000	9.7639	12.7511
MMF	non-significant variation			
ISS	non-significant variation			
#DISC	73.5106	59.6348	47.6364	42.2979

Figure 2. Mean scores of predictive variables for each job category.

	Res Sci 5	Res Eng 6	F	SIG
HRSSTI	14.4615	15.1957	7.372	0.0000
RRF	2.8995	2.9411	4.884	0.0002
TAF	3.2769	3.0007	3.258	0.0068
TIMESHD	21.6923	45.6809	5.033	0.0002
SPF	2.8464	2.8261	3.807	0.0022
IVF	2.8747	2.8149	5.624	0.0000
EIS	2.2308	2.5585	3.332	0.0058
IMIE	non-significant variation			
SORALIN	non-significant variation			
SPO	15.1250	13.2405	3.607	0.0034
MMF	non-significant variation			
ISS	non-significant variation			
#DISC	35.4615	47.2826	4.068	0.0013

Figure 2-cont. Mean scores of predictive variables for each job category.

IV. JOB PROFILES

The following variables were found to be predictors of job type:

- HRSSTI, Hours Worked Weekly with STI;
- RRF, Research and Reports Frequency of Use;
- TAF, Technical Applications Frequency of Use;
- TIMESHD, Time One Feels Should Spend on STI;
- SPF, Specialized Print Frequency of Use;
- IVF, Interpersonal and/or Verbal Frequency of Use;
- EIS, (Attitude toward) External Information Sources;
- IMIE, (Attitude toward) Immediate Management Information Environment;
- SORALIN, Preference for Information Sources Within One's Company;
- SPO, Scientific & Technical Personal Paper Collection Orientation;
- MMF, Major Media Frequency of Use;
- ISS, Information Satisfaction Scale; and
- #DISC, Number of Work-related Discussions.

Four of these variables were found not to vary significantly according to job type. These were: Immediate Management Information Environment; Preference for Information Sources Within One's Company; Major Media Frequency of Use; and Information Satisfaction Scale. As the differences among the values for "Job" aren't significant for these variables, they would add little in differentiating among the various job types and therefore will not be included in the discussion which follows. See Figure 3 for an ordinal ranking of job types on each of the nine remaining predictive variables.

The six job types as developed in the questionnaire are: manager; project leader; design engineer; production engineer; research scientist; and research engineer. A discussion of each job type as characterized by the above variables follows.

IV.1 Managers

Managers seemed to be the most verbose of the different job types. They rated highest on two "verbal" variables: first on Interpersonal and/or Verbal Frequency of Use and on Number of Work-related Discussions held during the previous month; second on attitude toward External Information Sources. Conversely, their stance with respect to printed matter was lowest of any of the categories. They scored lowest for the variables Specialized Print Frequency of Use and Scientific & Technical Personal Paper Collection Orientation, and were third out of six in Research and Reports Frequency of Use. Managers were next to last in considerations of Time One Should Spend on STI, and yet ranked highest on Hours Worked Weekly with STI. Finally, managers ranked second on Technical Applications Frequency of Use.

IV.2 Project Leaders

Project leaders rated highest on only one variable: Technical Applications Frequency of Use. However, they scored second highest on a number of variables, including Hours Worked Weekly with STI, Time One Should Spend with STI, Interpersonal and/or Verbal Frequency of Use, Scientific & Technical Personal Paper Collection Orientation, and Number of Work-related Discussions. Project leaders ranked third out

	HRSSTI	RRF	TAF	TIMESHD	SPF	IVF	EIS	SPO	#DISC
1.	MNGR	RESENG	PLEADER	RESENG	RESSCI	MNGR	PRODENG	RESSCI	MNGR
2.	PLEADER	RESSCI	MNGR	PLEADER	RESENG	PLEADER	MNGR	PLEADER	PLEADER
3.	RESENG	MNGR	DESENG	DESENG	PLEADER	PRODENG	DESENG	RESENG	PRODENG
4.	RESSCI	PLEADER	RESSCI	MNGR	DESENG	DESENG	RESENG	DESENG	RESENG
5.	DESENG	DESENG	PRODENG	PRODENG	MNGR	RESSCI	PLEADER	MNGR	DESENG
6.	PRODENG	PRODENG	RESENG	RESSCI	PRODENG	RESENG	RESSCI	PRODENG	RESSCI

MNGR: Manager
PLEADER: Project Leader
DESENG: Design Engineer

RESENG: Research Engineer
RESSCI: Research Scientist
PRODENG: Production Engineer

Figure 3. Ranking of job types on predictive variables. Order is from highest to lowest, as determined by ranking of means in figure 2.

of six for Specialized Print Frequency of Use, next to last for Research and Reports Frequency of Use, and last for External Information Sources.

It appears that project leaders can be shown by their ranking on the predictive variables to be somewhat transitional between "management" and "research" personalities. They score highly on the variables Hours Worked Weekly with STI, Interpersonal and/or Verbal Frequency of Use, and Number of Work-related Discussions; yet they also score highly on Scientific & Technical Paper Orientation--a variable characterized by its research emphasis. They are like managers in some respects and like researchers in others. They are also distinct from both of the aforementioned job types: they score poorly on both External Information Sources (managerial) and Research and Reports Frequency of Use (research). Thus, they appear to act as persons who are neither totally managers nor totally researchers. They share some traits of both groups, but not to the extent of being an "average" of the two categories.

IV.3 Production Engineers

Production engineers show some verbal orientation, but seem to rate worse on the "print" variables than any other group. They rate highest on External Information Sources and third highest on both Number of Work-related Discussions and Interpersonal and/or Verbal Frequency of Use--all variables falling along a "verbal" dimension. For all of the other variables (Hours Worked Weekly with STI, Research and Reports Frequency of Use, Technical Applications Frequency of Use, Time One Should Spend Working with STI, Specialized Print Frequency of Use, and Scientific & Technical Personal Paper Collection Orientation) they rank either last or next to last. It would appear that production engineers are characterized positively by none of the concepts involved, save that of communicating with others.

IV.4 Design Engineers

One's view of design engineers varies according to whether they are viewed alone or in relation to other groups (especially production engineers). Design engineers scored next to last on Hours Worked Weekly with STI, Research and Reports Frequency of Use, and Number of Work-related Discussions held. They scored fourth out of six on Specialized Print Frequency of Use, Interpersonal and/or Verbal Frequency of Use, and Scientific & Technical Personal Paper Collection Orientation. Their highest rating on any variable was third (out of six), on the variables Technical Applications Frequency of Use, Time One Should Spend on STI, and External Information Sources.

Viewed singly, they don't seem too terribly slanted along any particular dimension--their verbal orientation is marginal and their print orientation even less positive. Still, when viewed in relation to production engineers, one can see that design engineers are slightly less verbal than production engineers, as seen by their lower scores on Number of Work-related Discussions, External Information Sources, and Interpersonal and/or Verbal Frequency of Use. Design engineers show some improvement with respect to STI attitudes (higher scores on Hours Worked with STI, Research and Reports Frequency of Use, and Time One Should Spend on STI) and exhibit more print orientation than do production engineers (higher scores on Specialized Print Frequency of Use and Scientific & Technical Personal Paper Collection Orientation).

In absolute terms, design engineers represent a "median" of the variance displayed by all the job types; design engineers are more positively characterized than production engineers vis-a-vis the evaluative categories employed, but are less positively characterized than other types (e.g., managers).

IV.5. Research Scientists

Research scientists tend to be the antithesis of managers; they score quite highly on the "print" variables and quite poorly on the "verbal" and "STI" variables. Research scientists scored highest of all groups on Scientific & Technical Personal Paper Collection Orientation and Specialized Print Frequency of Use, and second highest on Research and Reports Frequency of Use. They scored fourth out of six on the "STI" variable Hours Worked Weekly with STI. They were last on Number of Work-related Discussions held, External Information Sources, and Time One Should Spend on STI. They scored next to last on Interpersonal and/or Verbal Frequency of Use. Research scientists appear to have a high print orientation, a low STI orientation, and a low verbal orientation.

IV.6 Research Engineers

Research engineers show characteristics that, while similar, are not as extreme as those of research scientists. Research engineers have the highest rating for Research and Reports Frequency of Use (similar to that of research scientists, who ranked second); yet, unlike the scientists, they have the highest ranking for Time One Should Spend with STI. They also have high scores on the print dimension variables: second in Specialized Print Frequency of Use, third for Scientific & Technical Personal Paper Collection Orientation, and first for Research and Reports Frequency of Use. They seem to be like the research scientists in that they have similar (though not as great) print orientation. They also have a corresponding lack of verbal orientation, though this characteristic is less attenuated: research engineers rank fourth out of six on Number of Work-related Discussions and External Information Sources, and last on Interpersonal and/or Verbal Frequency of Use. They also rank last on Technical Applications Frequency of Use.

Unlike the research scientists, research engineers have a high perceived Time One Should Spend on STI. They rank only third with respect to Hours Worked with STI, which seems to point to a discrepancy between what is and what ought to be, as far as research engineers and STI are concerned. Research engineers thus show some similarity with research scientists, especially with regards to rankings on print and verbal dimensions.

V. OBSERVATIONS AND CONCLUSIONS

The use of discriminant analysis allowed us to reduce the number of possible predictive variables from approximately fifty to the "best" thirteen. Of these thirteen variables, nine were found to vary significantly according to job type. Subsequent analysis of the means according to job type for these variables has proved useful for describing some pertinent characteristics of each job type. Further, patterns of relations have been discerned which would seem to indicate that certain variables or groups of variables are central to the prediction of job type. Also, a plot of scores on the variables for each of the types has proved useful for viewing the continuity (or lack of same) among the possible job categories.

In viewing the pattern of variation on the predictive variables by the various job categories, it has become evident that the categories align themselves along two main dimensions and along one minor dimension. The main dimensions are what have been called "print" and "verbal"; the minor dimension has been labelled "STI". See Figure 4.

The print dimension is tapped by three variables: Specialized Print Frequency of Use, Research and Reports Frequency of Use, and Scientific & Technical Personal Paper Collection Orientation. The verbal dimension is also assessed by three variables: Number of Work-related Discussions, Interpersonal and/or Verbal Frequency of Use, and External Information Sources. It is important to note here that the variation of job types on External Information Sources (as compared to that on the first two variables) would seem to indicate that other components besides a verbal one are present in the conceptualization of this variable. While these components cannot be specified (as they were not specifically probed), the sense of their existence can be taken as genuine. The dimension of STI is measured by two variables: Hours Worked with STI, and Time One Should Spend with STI. Unlike the first two dimensions, it fails by itself to distinguish among the job types; still, it does provide a finer level of distinction when used in conjunction with the first two dimensions. For these reasons this dimension is referred to as "minor". The only variable unaccounted for in this reclassification is that of Technical Applications Frequency of Use. It, like the STI dimension, appears to provide some discriminatory capabilities, but they are relevant only in the presence of the two major dimensions (print and verbal); also, the variable provides less analytical power than does the STI dimension.

The print dimension seems to divide the possible job types into those who "think"; who deal with information which exists at a more refined level and those who "do"; who deal mainly with the immediate results information or with information at a more basic or "raw" level. Thus, we find that research scientists and research engineers rate highest on print orientation and that production engineers rank lowest. One can conceive of research scientists and research engineers as being concerned with information which is refined to a publishable stage, while production engineers would be most concerned with information as it is produced; while it is still "hot". There is some variation in the middle ranges, where design engineers, managers, and project leaders are to be found. This may be at least partially due to differences in emphasis among the variables which comprise the print dimension.

Inspection of rankings on the variables comprising the verbal dimension reveals that this is something of an inverse of the print dimension. Here we find (looking at Number of Work-related Discussions and Interpersonal and/or Verbal Frequency of Use) that managers, project leaders, and production engineers are the three highest-ranking categories, while research scientists and research engineers rank the lowest. Once again, design engineers are located in the middle of the spectrum. Returning to the contrast of management and research personalities, one

Print Dimension Variables

RRF	SPF	SPO
RESENG	RESSCI	RESSCI
RESSCI	RESENG	PLEADER
MNGR	PLEADER	RESENG
PLEADER	DESENG	DESENG
DESENG	MNGR	MNGR
PRODENG	PRODENG	PRODENG

Verbal Dimension Variables

#DISC	IVF	EIS
MNGR	MNGR	PRODENG
PLEADER	PLEADER	MNGR
PRODENG	PRODENG	DESENG
RESENG	DESENG	RESENG
DESENG	RESSCI	PLEADER
RESSCI	RESENG	RESSCI

STI Dimension Variables

HRSSTI	TIMESHD
MNGR	RESENG
PLEADER	PLEADER
RESENG	DESENG
RESSCI	MNGR
DESENG	PRODENG
PRODENG	RESSCI

Unclassified Variable

TAF
PLEADER
MNGR
DESENG
RESSCI
PRODENG
RESENG

Figure 4. Predictive variables reclassified along three dimensions.

could view managers as communicating information verbally, since this allows for the most immediate use of information. This is in contrast to researchers, whose print orientation implies a valuation of information for more esoteric and less strictly applicational reasons. Some variation in research engineers is also present. When External Information Sources is incorporated into the analysis certain changes occur. The only major change is that project leaders change from a rank of two to that of five on the scale. While there is some shuffling of job types in the categories, this (the low score on a verbal dimension variable by project leaders) represents the only significant "crossover", and may possibly be due to some sort of orientation by project leaders toward non-verbal external information sources.

Thus far, we see that distinctions can be drawn according to one's position with respect to the information involved. Those who tend to synthesize or extract information are slanted towards a print orientation, while those work with the results of information production tend to be slanted towards a more verbal orientation.

The STI orientation dimension provides two variables with which to make further distinctions in light of the two predictive dimensions discussed above. Hours Worked with STI tends to separate out production engineers from the other categories (i.e., managers and project leaders) who rely on verbal information transfer. Managers and project leaders rank first and second respectively on Hours Worked with STI, but production engineers rank last. Research engineers and research scientists rank third and fourth respectively on Hours Worked with STI; what is of note is that they remain in close proximity on the variable. Time One Should Spend in STI provides a means of distinguishing among these two "print" personalities. Research engineers rank first on the variable, while research scientists rank last--no greater variation could be possible on this variable. The remaining job categories tend to sort somewhat randomly on Time One Should Spend with STI.

The final variable, Technical Applications Frequency of Use, adds little discriminatory or predictive power to the other variables. The one trait which the variable may tap would be that of one's degree of pragmatism. That project leaders rank first on Technical Applications Frequency of Use (ahead of managers) may reflect the fact that they are concerned more than managers with achieving the goals set before them. Such a conclusion would have to be qualified in two ways, both stemming from the fact that the objectives of project managers may be more quantifiable and less diffuse than those of managers. First, if the goals of a project manager are easier to specify, then one can better determine the best method for achieving such goals, and can be more pragmatic in evaluating approaches to goal achievement. Also, a variable such as Technical Applications Frequency of Use will measure the behavior of those pursuing well-defined objectives more accurately than it will measure the behavior of those pursuing goals whose nature are less well-defined.

The use of geometric conceptualizations in STI behavior research has proved to be quite useful. Graphing the scores of the job types on the predictive variables on a Cartesian coordinate system, with the predictive variables arranged along the x-axis and the range of possible scores arranged along the y-axis, facilitates visual inspection of the relations previously discussed. See Figures 5, 6, and 7. Thus, managers and project leaders tend to have similar traits (as evidenced by similar shapes of the graphs of their scores (see Figure 7), as do research engineers and research scientists (see Figure 6).

Production engineers tend to rank low on all the variables (save External Information Sources) and design engineers tend to remain in the middle of the spectrum. Within the groups discussed, one gains a sense that research engineers are like research scientists, though the former are less extreme than the latter. The same can be said for project leaders and managers. Production engineers seem to fill the lower end of the continuum, though their positive characteristics are probably not well assessed, save through the variable External Information Sources. Design engineers seem to be a compromise between the research/print and managerial/verbal camps. See Figure 5.

The fact that the variables discovered through the discriminant analysis process are valid predictors for the job classifications and the fact that they tend to group the job categories into higher-level orders which are intuitively sensible tends to validate the entire enterprise of "three-dimensional analysis" outlined in the introductory section. More importantly, it also makes a compelling argument for the fruitfulness of applying such a methodology in the attempt to understand the orientations and needs of the members of specific organizations.

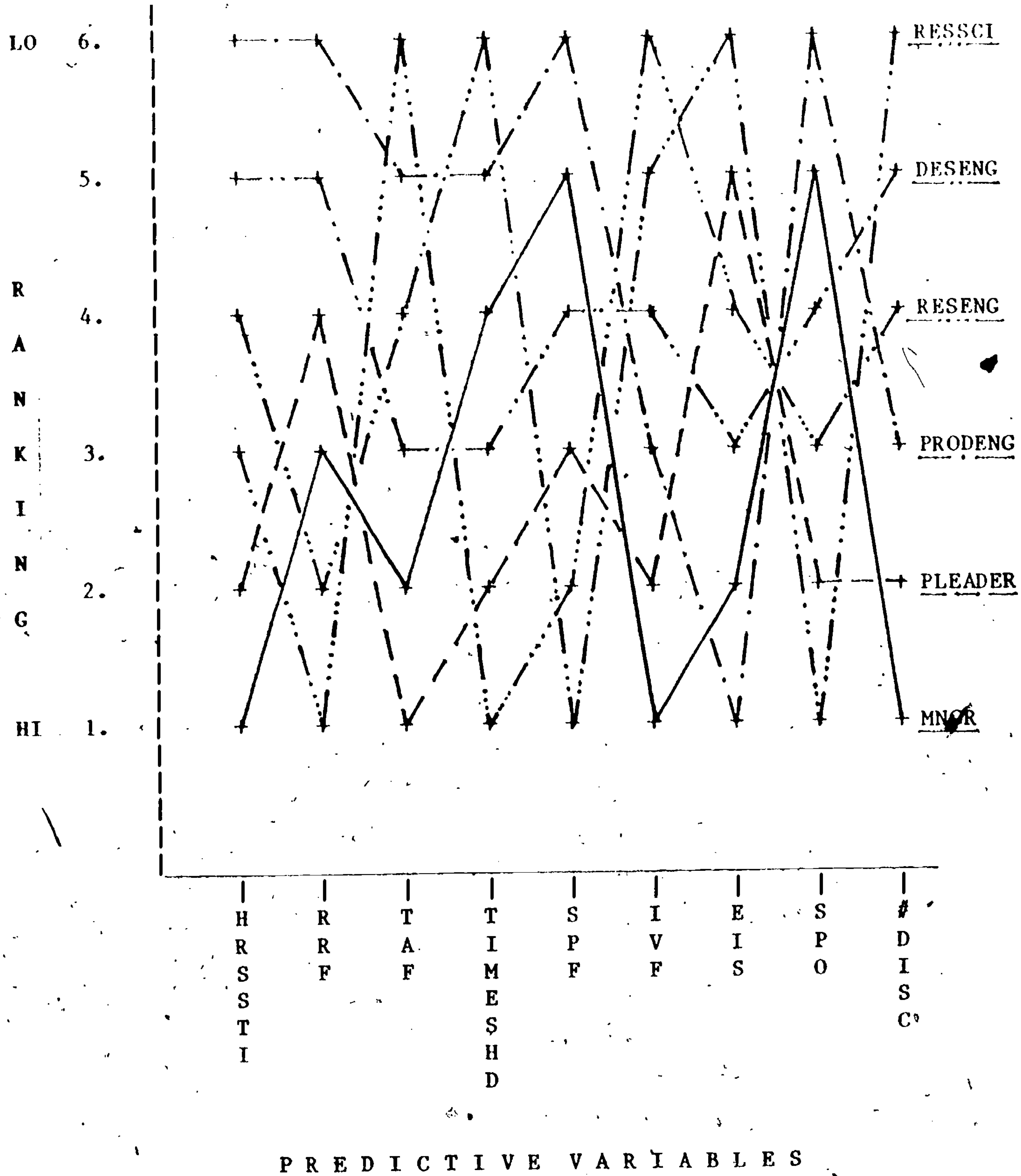

Figure 5. Ranking of all job types on predictive variables.

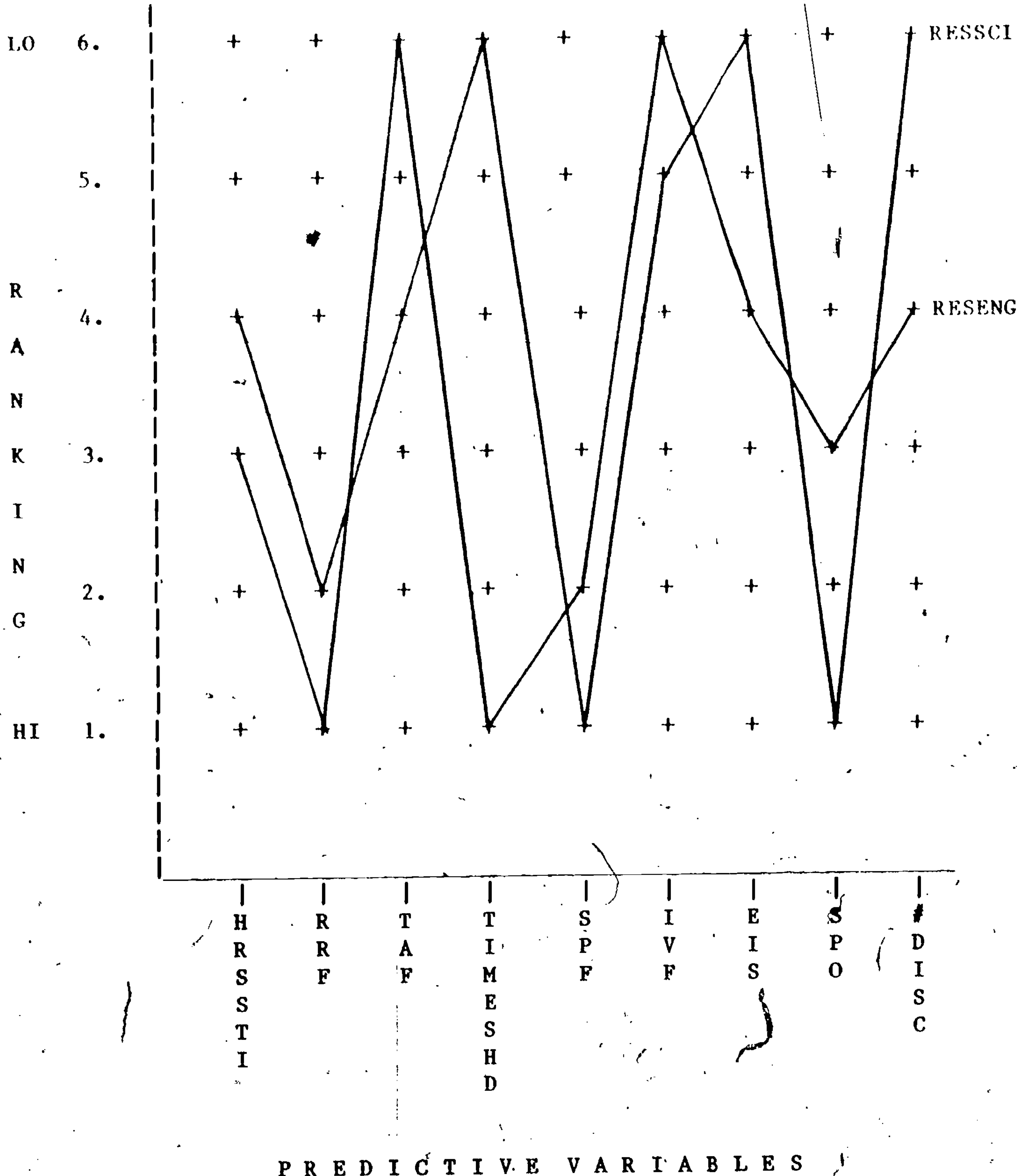

Figure 6. Ranking of job types RESSCI, RESENG on predictive variables.

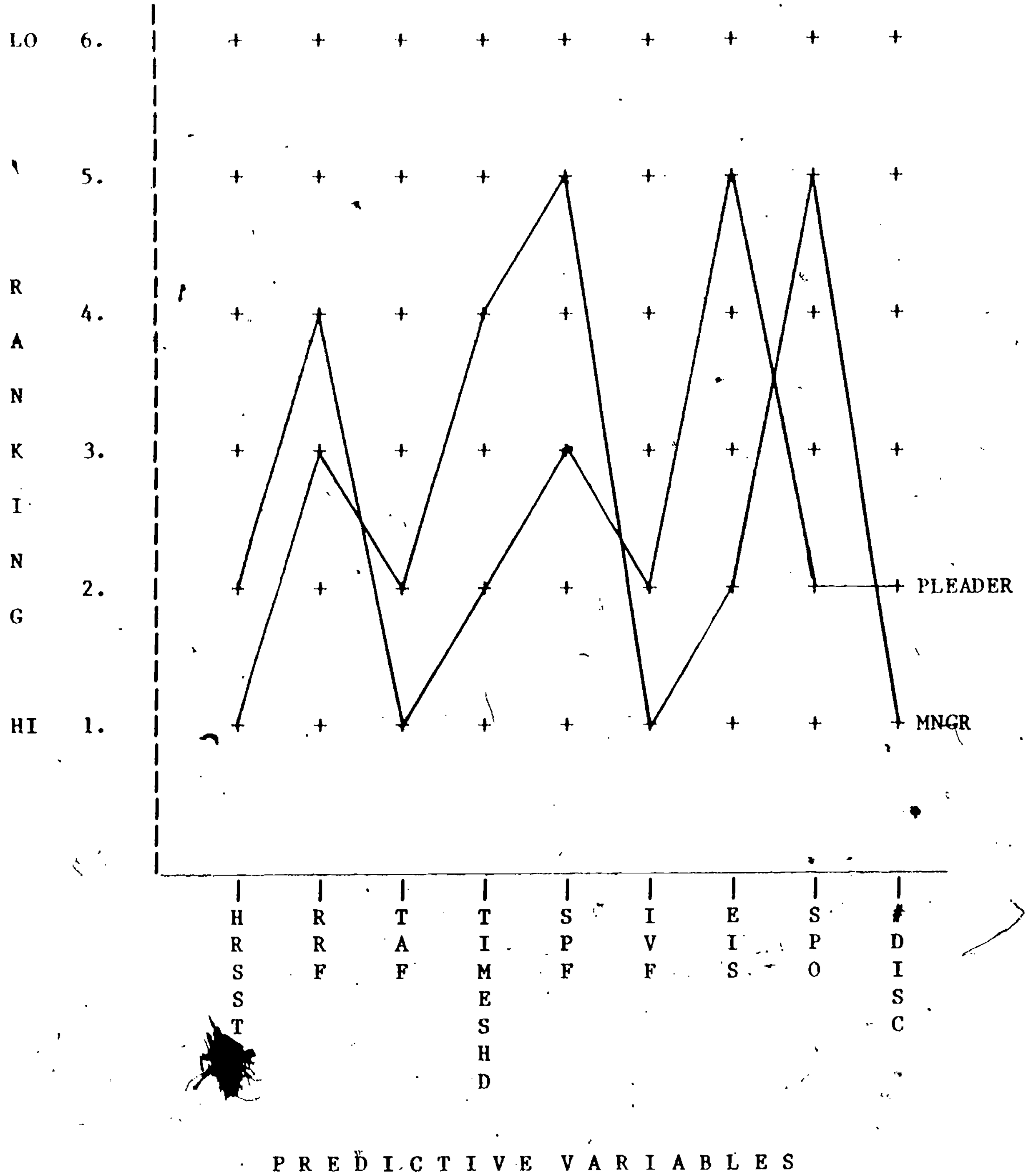

Figure 7. Ranking of job types MNGR, PLEADER on predictive variables.

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