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AFOSR 2416

SYSTEMS OF INFORMATION IN SMALL GROUP RESEARCH STUDIES

HSR-TN-62/2-Gn

April, 1962

By:

Joseph E. McGrath

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Prepared for:

Air Force Office of Scientific Research
Office of Aerospace Research
Washington, D. C.

Contract No. AF 49(638)-256, Supplemental Agreement No. 5(62-341)

HSR

human sciences research inc

FILLMORE AND WILSON BOULEVARD
ARLINGTON 1, VIRGINIA

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HUMAN SCIENCES RESEARCH, INC.
1408 N. Fillmore Street
Arlington 1, Virginia

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FOREWORD

This is the seventh technical report in a program of research designed to integrate existing knowledge in the small group research field. The research program has been conducted by Human Sciences Research, Inc. under contract AF 49 (638)-256 with the Behavioral Sciences Division of the Air Force Office of Scientific Research.

The purpose of the program has been to develop and apply a classification system designed to provide a systematic integration of existing research information about small groups. The classification system, techniques for its application, and a number of end-products resulting from its use, have been described in six previous technical reports. This report deals with our attempt to "validate" the classification system, by investigating how well it isolated consistently significant relationship classes within the body of small group research information. The eighth technical report of the program, which will be titled "A Summary of Small Group Research Information," utilizes results of this validation study to provide a summary of major relationships which have received consistent empirical verification in small group research studies.

Dr. Joseph E. McGrath, principal investigator throughout the program and author of this report, is now a member of the Psychology Department, University of Illinois. Dr. Irwin Altman, co-investigator during most of the program, is now with the Special Operations Research Office, American University. We gratefully acknowledge the many contributions of Dr. Altman, Mrs. Anita Terauds, and many other former and current members of HSR's research staff. We also wish to thank the many small group research scientists whose research findings provided the substance of our studies and whose comments and suggestions contributed appreciably to the progress we have made. We are especially grateful to Dr. Charles E. Hutchinson,

Chief of the Behavioral Sciences Division, Air Force Office of Scientific Research and monitor of this research program. His continuing patience and encouragement, as well as his deep appreciation for the role of basic research, have provided the necessary conditions for successful conduct of this research program.

ABSTRACT

SYSTEMS OF INFORMATION IN SMALL GROUP RESEARCH

Joseph E. McGrath

Human Sciences Research, Inc., Arlington, Va.: April 1962.

(AFOSR Document No. 2416, HSR-TN-62/2-Gn)

This is the seventh technical report in a program of research designed to integrate existing knowledge in the small group research field. The research program has been conducted by Human Sciences Research, Inc. under contract AF 49 (638)-256 with the Behavioral Sciences Division, Air Force Office of Scientific Research.

The purpose of the program has been to develop and apply a classification system designed to provide a systematic integration of existing research information about small groups. The classification system, techniques for its application, and a number of end-products resulting from its use, have been described in six previous technical reports. This report is an attempt to "validate" the classification system itself, by investigating how well it isolated those variables which show consistently significant relationships within the body of small group research information.

Results clearly support the "validity" of the classification system as a means for systematic organization of small group research information. Moreover, the findings suggest that the small group literature contains six relatively distinct "systems of information," namely: (1) structural characteristics of group members; (2) dynamic characteristics of members; (3) structural properties of the group itself; (4) behavioral or dynamic properties of the group; (5) structural characteristics of the group's environment; and (6) environmental processes. The findings of the validation study indicate that variables within each of these six subsystems show consistent interrelationships, while relatively few significant relationships hold between variables from different subsystems.

These results have critical implications for basic strategy of future research on small groups. Moreover, they make it possible to develop a much simplified summary of the major empirical relationships which have been consistently verified in small group studies. This supplementary task of the program is currently being completed, and will be presented in the eighth and final technical report of the program, titled "A Summary of Small Group Research Information."

SYSTEMS OF INFORMATION IN SMALL GROUP RESEARCH STUDIES

This study examines the empirical "structure" of research information in the small group field. It was conducted as part of a research program designed to integrate existing knowledge about small groups. Earlier phases of the program were concerned with the development of a predictive classification system (McGrath, 1957; Altman and McGrath, 1959), and with its application to the research information contained in a sample of 250 small group studies (Altman, Jenkins, and McGrath, 1959; Altman and Terauds, 1960; Altman, Pendleton, and Terauds, 1960; Terauds, Altman, and McGrath, 1960). This study was conducted to "validate" the classification system by testing its predictive utility. Results suggest that the research information of the small group field can be subdivided into six relatively independent "subsystems" of information. The variables which lie within each of the subsystems tend to show consistent patterns of interrelationship, while there is relatively little consistency in relationships between the subsystems. The first sections of this paper describe the rationale of the program and the classification system upon which the analysis is based. This is followed by presentation of results of the analysis, and by a discussion of their implications for research on small groups.

The Problem

Background

The research program began in 1957, under the impetus of two widely recognized facts. First, a tremendous volume of small group research had been produced in recent decades, and the rate of production

was rapidly increasing. Second, there was no general, widely accepted theoretical structure which could guide research in small groups or provide a frame of reference for interpretation of results. Consequently, new research information was tending to "pile up" in a relatively scattered, unintegrated manner, rather than adding to a systematic body of knowledge about small groups. While several investigators (e. g., Lindzey, 1954; Hare, Borgatta, and Bales, 1955; Cartwright and Zander, 1953) had made major inroads on the problem, even those authors decried the need for broader theory, for definition of basic parameters, and for detailed integration of findings in various parts of the field. The research program was an attempt to partly meet those needs.

Rationale

The first aim of the research program was to develop a method for systematic description and comparison of small group research findings. We wanted to be able to "place" any finding in any small group study in relation to all other findings of the field. Such a goal implies the development of a logically-closed classification system whose terms of reference generate a set of mutually exclusive, collectively exhaustive classes or categories, each of which is distinguished from and related to all of the other categories. Thus, we attempted to develop a "strong" classification system which would assign each finding to a point in a structured, multidimensional classification "space," rather than merely to assign it to one of a set of unrelated nominal classes.

We also wanted a classification system which would have predictive as well as descriptive value. Knowing that a certain species is classified as a mammal permits one to predict, with considerable accuracy, a number of characteristics of that species over and above those which define the class, mammal. In the present context, the aim was to develop a

classification system which would permit us to predict whether or not a given variable would be related to any other given variable if their relationship were tested empirically. Specifically, we wished to develop a system which would permit us to make a probability statement about the chances that any given relationship, Rij, between a variable of class i and a variable of class j, would be significant at a fixed alpha level. This requirement implies that the ordering principles of the classification system are also fundamental ordering principles for the empirical phenomena to which the classification system refers.

The advantages of such a "strong" predictive classification system are many. Such a classification system could "sort" existing research information into sets of relatively well-established relationships to provide the basis for empirical generalizations and ultimately for development of broad, empirically-based theory. It could also identify the areas where current information is contradictory or incomplete, thus identifying needed research. The predictive aspect of the classification system would also make it possible to foresee the consequences of failure to include and/or to measure particular variables, and thus provide a guide for more efficient programming of research.

One further advantage of a predictive classification system is that its "validity" can be tested. The usefulness of a descriptive classification system can only be assessed in terms of how much it simplifies the handling of a mass of information. A predictive classification system, on the other hand, can be assessed in terms of the extent to which it does, in fact, order concepts in a manner which corresponds to empirical phenomena. This paper describes the validation step of the research program.

The Classification System[1]

The goal of the classification system was to organize research information contained in the small group literature. The unit of research information was assumed to be the statement of results of a statistical test which examines the relationship between two variables. Each such statement has three parts: (1) an agent variable; (2) a resultant variable; and (3) an alpha level, or a statement of the probability associated with the statistical test of relationship between the two variables.

Each variable which serves as Agent or Resultant variable in a relationship statement is operationally defined in terms of responses or measures on one or more data items. A data item is a specific single response or judgment. The basic terms of classification have to do with the operational characteristics of the data items which underlie a given variable.[2]

Basic Parameters of Data

The classification system postulates six basic parameters or operational characteristics, each with a number of levels or categories. Each data item is described in terms of one and only one category on each of the six parameters. The parameters, their definitions, and their categories are summarized below and described in detail elsewhere (Altman and McGrath, 1959).

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1. The classification system is presented in detail elsewhere (Altman & McGrath, 1959). Therefore, the classification system is described here only to the extent necessary to clarify exposition of the validation study.

2. The classification system also deals with the operational procedures by which responses to a set of data items are combined to form a unitary measure of a variable. Such "indexing operations" are not germaine to the results presented in this paper, however, and are therefore not described here.

Object. The object of a data item is the level of reference of the entity to which that response or judgment refers. For example, if a data item deals with a characteristic of a group member, then it is at the individual (member) level of reference. If the judgment or response deals with the group as an entity, then its object is at the group level of reference. Major categories for the Object parameter are: Member (self, other); Group; Environment (individual, group, object).

Mode. The mode of a data item refers to the type of characteristic which is being judged in that data item. If the data item refers to a static or persevering property of its object (a "trait"), its mode is designated as State. If it refers to an action, behavior, or change in the object, its mode is designated as Action.

Source. The source of a data item refers to the person or instrument making the response. If the data item is based on self report by a group member, its source is designated as Member. If it is based on the joint response of two or more members, it is designated as Group. The categories of the Source parameter are: Member; Group; External (investigator, investigator surrogate, instrument).

Viewpoint. The Viewpoint parameter refers to the frame of reference from which the source makes the judgment which constitutes a data item. If a member makes a judgment from his own viewpoint, the data item is characterized as Subjective. If he attempts to estimate the judgment of another member of the group, the data item is classified as Projective. If a member or the investigator attempts to respond from an impersonal frame of reference, the data item is classified as Objective.

Task.[1] The Task parameter refers to the type of judgment which is made about the object. If the judgment has to do with the amount of a characteristic possessed by the object, it is classified as Descriptive. If the judgment has to do with the degree to which the object departs from a standard or ideal on a characteristic, it is classified as Evaluative.

Relativeness.[1] The Relativeness parameter refers to the absolute or comparative basis of the response. If a data item represents an absolute judgment about a characteristic of an object, it is classified as Irrelative. If it refers to a comparison of an object with one or more other objects, it is classified as Relative.

Classes of Variables

Each data item is classified in one and only one of the categories of each of the six basic parameters. Thus, the parameters define a set of related classes, each of which is characterized by a specific combination of categories. The number of data classes is the product of the number of categories of the six parameters.

A variable may be composed of a single data item or a combination of several data items. Variables which are made up of one data item, or a number of data items of the same data class, are termed Simple variables. There are as many classes of Simple variables as there are data classes. Variables which are made up of data items from two or more data classes are termed Complex variables. While there are a huge number of potential classes of Complex variables, relatively few of them have been employed in the sample of studies reviewed in this program. Consequently, most of the analyses presented here deal with Simple variable classes only.

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1. The Task parameter is identical to Coombs' (1952) distinction between Task A and Task B, while the distinction between Relative and Irrelative judgments is also borrowed from Coombs' "theory of data."

All variables which are based on data items having the same combination of categories on the data parameters belong to the same variable class, Vi. All members of a variable class, Vi, are alike from the point of view of this classification system. Furthermore, they all bear the same relationship to any variable which is a member of the class Vj. Hence, the statistical test of relationship between a variable of the class Vi and variable of the class Vj, which is termed Rij, is considered a test of the relationship between those two classes. Given that there are a number of specific instances of tests of relationship between variables of class Vi and variables of class Vj, then the proportion of those tests which achieve a given alpha level is an index of the probability of relationship for any member of the relationship class Rij. The proportion of relationships of a class Rij which achieve a given alpha level is termed the "batting average" for the relationship class Rij. It is considered an estimate of the probability that any given variable Vi will be related to a given variable Vj.

The Concordance Principle

It was assumed that two variables which are classified alike in all respects are identical within the frame of reference of the classification system. Further, it was assumed that the more parameters on which two variables are classified alike, the more similar are those two variables to one another. One index of the degree of similarity between any two variables is a simple count of the number of parameters on which those two variables have the same classification category. This index is termed the Concordance level of the relationship between those two variables.[1]

1. The index of Concordance level for relationships which are not the Simple type is somewhat more complex than here described. However, results for Simple relationship classes and for all relationship classes are so parallel (see Table 1, Figure 1) that further analyses focused solely on the former. Furthermore, several more complex indices of Concordance, including a priori weighting methods, did not appreciably alter the Concordance/"batting average" function; hence, the simple counting measure was used.

Thus, it is possible to order all relationship classes, Rij, into one of seven levels of Concordance: those in which the two variables are alike on all six parameters; those in which the two variables are alike on five of the six parameters; and so forth, down to those whose variables are dissimilar on all six parameters.

The basic predictive hypothesis of the classification system was that the more two variables are alike (that is, the higher their level of Concordance), the greater the chances that they will be significantly related to one another at any fixed alpha level. Thus, we predicted a positive association between the Concordance level and the "batting average" of the relationship classes in the small group field.

Results

The Concordance hypothesis was tested by the following procedures. All relationships in 250 small group studies were assigned to one of seven levels of Concordance. A Concordance level of 6 was assigned to all relationships in which the two related variables had the same classification on all six parameters. A Concordance level of 5 was assigned to relationships in which the two variables were classified the same on five but different on one parameter. The minimum Concordance score, 0, was assigned to relationships in which the two variables were dissimilar on all six parameters.

Then, we computed the proportion of relationships within each Concordance level which were statistically significant. An alpha level of $p = .05$ was used for all analyses. Then these proportions, or "batting averages," were compared for different levels of Concordance.

Concordance Level vs. "Batting Average"

Table 1 and Figure 1 show results for all relationship classes and for those relationship classes in which both variables are Simple in their data-item composition.[1] It is not appropriate to apply standard statistical tests to assess the degree of association between Concordance level and "batting average," because these data do not meet the requirement of "experimental independence" of cases. Nevertheless, the data appear to depart markedly from the "flat-line" which would be expected if only a chance association existed between Concordance level and "batting average." For the maximum Concordance level, 53% of all relationships and 56% of all simple type relationships were significant at the .05 level; while, for minimum Concordance, only 26% of all relationships and 28% of all simple type relationships achieved that alpha level. Other analyses, based on more complex measures of Concordance, gave essentially the same results. These findings were taken to indicate at least tentative support for the Concordance hypothesis.

Contribution of Individual Parameters

We next examined the separate contributions of each of the six parameters to the over-all association between Concordance level and "batting average." Table 2 and Figure 2 show results for all simple relationship classes and for 44 major relationship classes.[2] The Relativeness parameter was omitted from further analysis because over 90% of all variables were classified in one of its two categories.

The Object parameter was clearly the strongest single contributor to the Concordance/"batting average" relationship, while Mode, Source

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1. See footnote 1, page 7.

2. Major relationship classes were those for which there were at least 25 instances and which occurred in at least three different studies. The 44 major relationship classes included over 3,000 total relationships. The criterion for selecting major relationships differs slightly from the criterion of 20 used in Altman & Terauds, 1960.

TABLE 1

ASSOCIATION BETWEEN CONCORDANCE LEVEL AND "BATTING AVERAGE"

	All Relationship Classes			Simple Relationship Classes		
Concordance Levels*	Significant Relationships	Total Relationships	"Batting Average"**	Significant Relationships	Total Relationships	"Batting Average"**
0	13	49	26%	12	44	28%
1	256	834	31%	242	762	32%
2	592	1909	31%	515	1618	32%
3	576	1635	35%	504	1403	36%
4	578	1995	29%	492	1599	31%
5	607	1541	39%	510	1222	42%
6	600	1135	53%	538	969	56%
		9098			7617	

* Concordance level equals number of parameters on which the two variables of the relationship have similar classification.

** "Batting average" equals proportion of relationships at a given Concordance level which are significant at or beyond the .05 level.

FIGURE 1

ASSOCIATION BETWEEN CONCORDANCE LEVEL AND "BATTING AVERAGE"

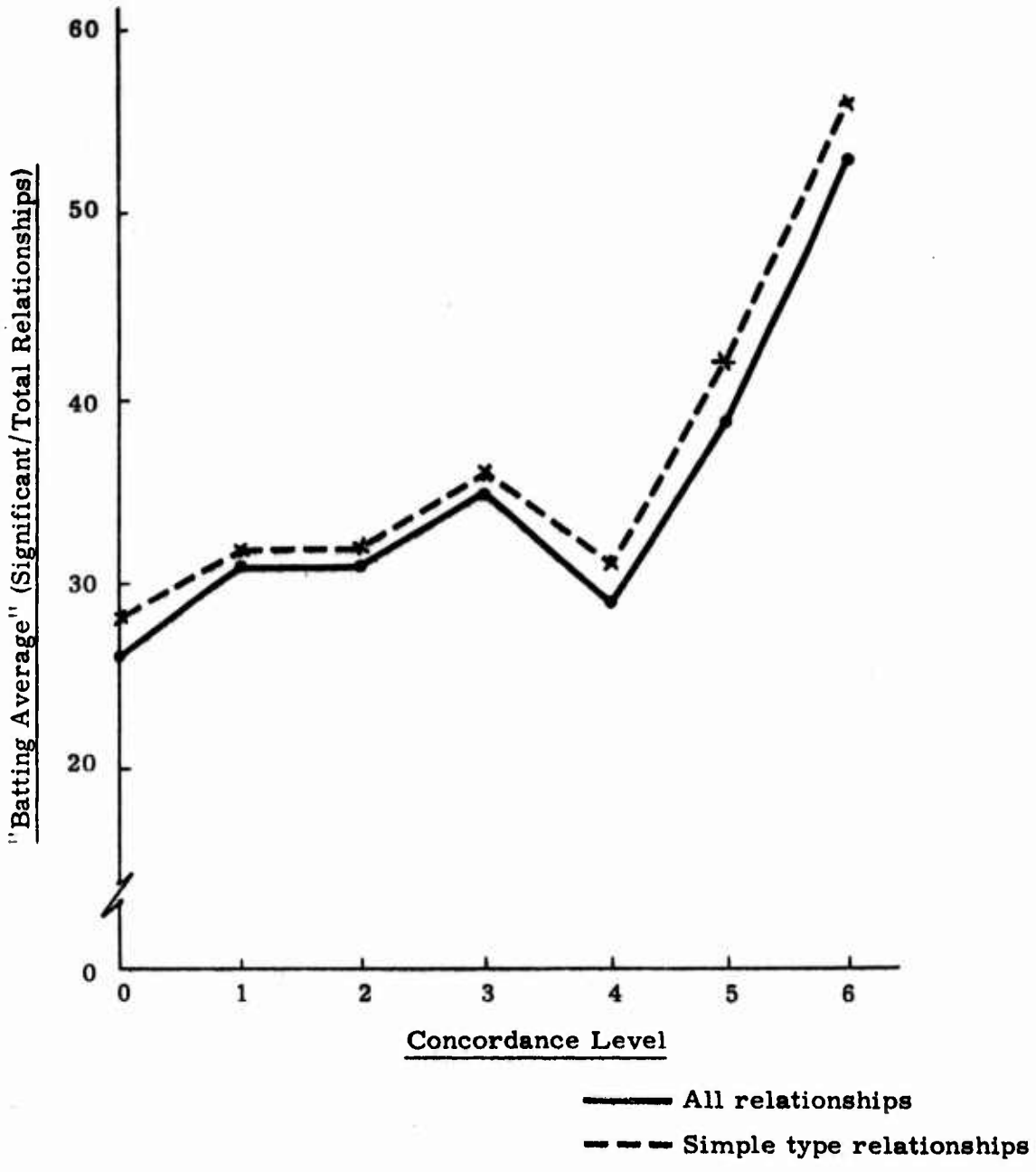


TABLE 2

ASSOCIATION BETWEEN CONCORDANCE ON INDIVIDUAL PARAMETERS AND "BATTING AVERAGE"

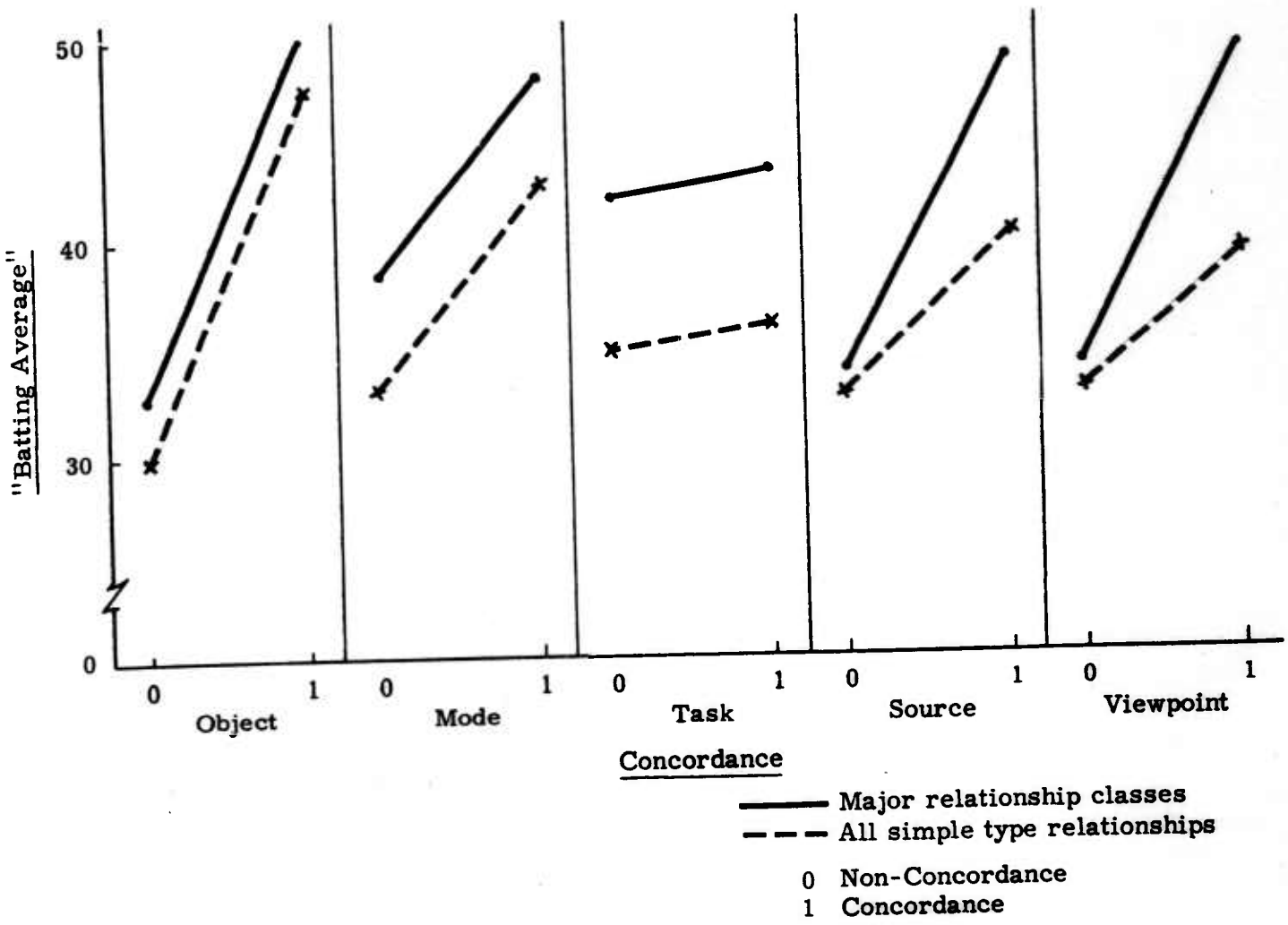
Parameters**	Major Relationship Classes*		All Simple Type Relationships
	No. of Classes	"Batting Average"	"Batting Average"
Object			
Concordance	23	50%	48%
Non-Concordance	21	32%	30%
Mode			
Concordance	21	48%	42%
Non-Concordance	23	39%	33%
Task			
Concordance	22	43%	37%
Non-Concordance	22	42%	36%
Source			
Concordance	24	49%	39%
Non-Concordance	20	34%	33%
Viewpoint			
Concordance	24	48%	40%
Non-Concordance	20	34%	33%
Total	44	43%	37%

*Major relationship classes are those which have at least 25 relationships and which appear in at least three studies.

**The Relativeness parameter was omitted from the analysis because over 90% of all relationships were classified into one of its two categories.

FIGURE 2

ASSOCIATION BETWEEN CONCORDANCE ON
INDIVIDUAL PARAMETERS AND "BATTING AVERAGE"



and Viewpoint parameters also appeared to have made substantial contributions. The Task parameter, however, did not contribute to the over-all relationship. Furthermore, examination of the data showed that the Source and Viewpoint parameters, while conceptually distinct, were almost entirely redundant in these data. Therefore, it was concluded that three parameters had made major contributions to the association between Concordance and "batting average," namely, the Object and Mode parameters and Source-Viewpoint considered as a joint parameter.

Additive Combinations of Two and Three Parameters

Concordance levels were then compared to "batting averages" for pairs, and for all three, of the effective parameters--Object, Mode and Source (Table 3 and Figure 3). The Concordance/"batting average" relationship for the additive combination of Object, Mode and Source is almost perfectly linear, with a slope equalling that obtained when all six parameters were taken into account. Relationships which are concordant on all three parameters have a "batting average" of 57%, while those which are not concordant on any of the three parameters have a "batting average" of only 26%.

Lexicographic Combination of Parameters

The possibility of nonadditive combinations of the three parameters was next considered. A "batting average" was computed for each of the eight combinations of Concordance and non-Concordance for the three effective parameters. These were then arranged in terms of combinations of the Mode and Source parameters for Object Concordance and Object non-Concordance separately (Table 4 and Figure 4). These data indicate that, while the Object parameter was clearly the most effective single parameter, the Mode and Source parameters appeared to have different

TABLE 3

ASSOCIATION BETWEEN "BATTING AVERAGE"
AND CONCORDANCE ON TWO AND ON THREE PARAMETERS
FOR MAJOR RELATIONSHIP CLASSES

Level of Concordance	"Batting Averages" for Two-Parameter Combinations: Object & Mode	Object & Source	Mode & Source
Concordance on both parameters	57%	51%	54%
Concordance on one parameter	40%	44%	42%
Non-Concordance on both parameters	32%	28%	32%

Level of Concordance	"Batting Averages" for Three-Parameter Combination
Concordance on all three parameters	57%
Concordance on two of the three parameters	46%
Concordance on one of the three parameters	37%
Non-Concordance on all three parameters	26%

FIGURE 3

ASSOCIATION BETWEEN "BATTING AVERAGE" AND CONCORDANCE ON OBJECT, MODE, AND SOURCE FOR MAJOR RELATIONSHIP CLASSES

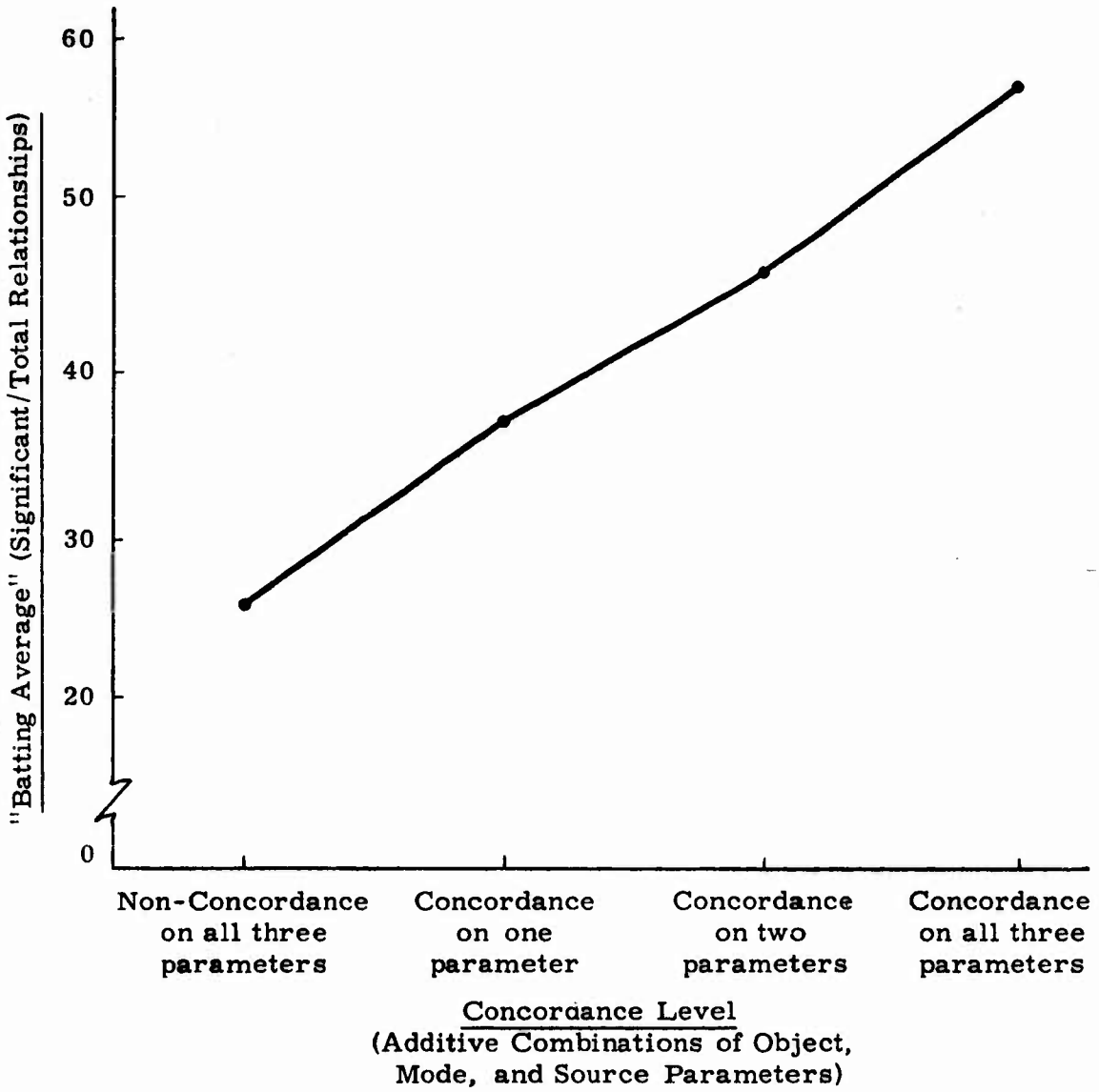


TABLE 4

ASSOCIATION BETWEEN "BATTING AVERAGE" AND CONCORDANCE ON MODE AND SOURCE PARAMETERS FOR OBJECT CONCORDANT AND OBJECT NON-CONCORDANT RELATIONSHIPS

Object Concordance

	Source Concordance	Source Non-Concordance	Total
Mode Concordance	57%	56%	57%
Mode non-Concordance	45%	43%	45%
Total	51%	47%	50%

Object Non-Concordance

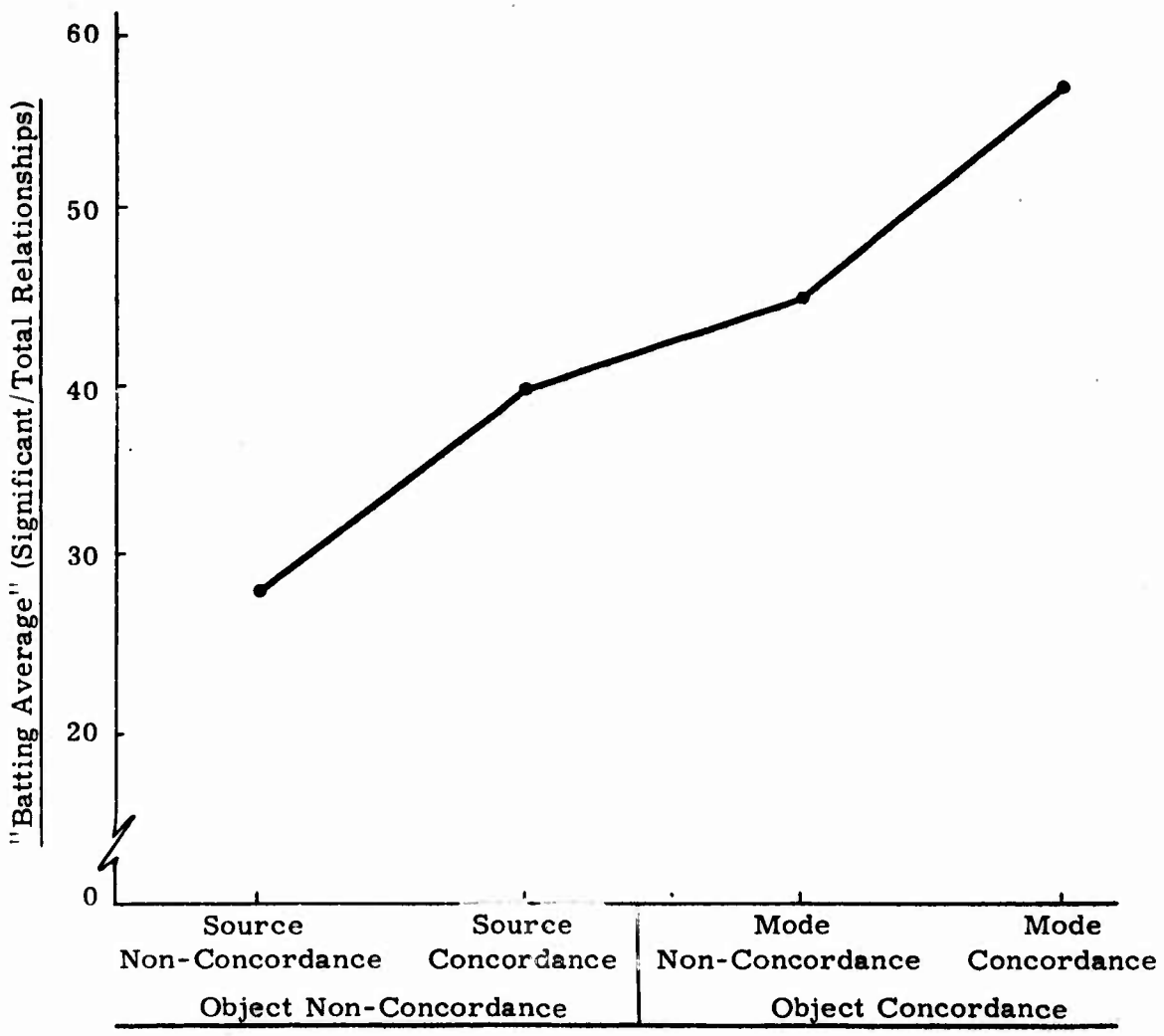
	Source Concordance	Source Non-Concordance	Total
Mode Concordance	38%	31%	33%
Mode non-Concordance	41%	26%	32%
Total	40%	28%	32%

Lexicographic Combination

Concordance Combination	"Batting Average"
Object Concordance and Mode Concordance	57%
Object Concordance and Mode non-Concordance	45%
Object non-Concordance and Source Concordance	40%
Object non-Concordance and Source non-Concordance	28%

FIGURE 4

ASSOCIATION BETWEEN CONCORDANCE AND "BATTING AVERAGES" FOR THE LEXICOGRAPHIC COMBINATION OF OBJECT, MODE, AND SOURCE PARAMETERS



effects for Object Concordant and Object non-Concordant relationships. Specifically, Concordance or non-Concordance on the Mode parameter was related to "batting average" for Object Concordant relationships, but not for those relationships in which there was non-Concordance of Object. Conversely, Concordance on the Source parameter seemed to make a difference in "batting average" for relationships with non-Concordant Objects, but not for relationships with Concordant Objects.

These findings suggest that the three parameters combine in a lexicographic (Coombs, 1952) rather than an additive fashion. The Object parameter is dominant. The Mode and Source parameters are secondary parameters, the former operating only when there is Object Concordance and the latter operating only when there is Object non-Concordance. Thus, substantially all the predictability of the Concordance hypothesis appears to be subsumed in three basic distinctions:

1. Do the variables being related have the same or different levels of reference? (Object Concordance or non-Concordance)

2. If the same in level of reference, then do both refer to states or actions, or is one a state variable while the other is an action variable? (Mode Concordance or non-Concordance, given Object Concordance)

3. If different on level of reference, then are data on both variables from the same or different sources? (Source Concordance or non-Concordance, given Object non-Concordance)

Analysis by Categories

Some analyses were also conducted to determine whether specific categories of the various parameters made a difference in "batting average" over and above the effect of level of Concordance. This question could not be fully explored, even with the rather voluminous data of this study.

However, there was some indication that relationships between two variables at the group level of reference were more likely to be significant than relationships between two variables at the member level of reference (56% vs 48%). The direction of this difference was consistent for Mode Concordant and Mode non-Concordant relationships. Although this difference is relatively small, it tends to confirm a previous finding (McGrath, 1957), which indicated that relationships between two measures at the group level of reference were more likely to be significant than relationships between measures at the individual level.

Discussion

Summary of Results

The Concordance principle appears to be generally supported, although the nature of the data does not permit a firm statistical test of the hypothesis. Results strongly suggest that the proportion of relationships found to be statistically significant (at a given alpha level) is associated with the degree of Concordance of the two classes of variables whose relationships are being examined. Thus, the parameters of the classification system appear to be, at least to some extent, valid. Application of the classification system permits ordering of research relationships into classes on the basis of level of Concordance, and these classes show a parallel order in terms of "batting average."

However, not all of the distinctions included in the classification system contributed to this differentiation. The discriminability of the system comes, for the most part, from classification on Object, Mode and the Source-Viewpoint parameters. Results also suggest that a nonadditive (lexicographic) combination of the parameters may be more efficient than an additive combination. Specifically, the Object parameter appears to be

dominant, while the Mode and Source-Viewpoint parameters are effective only within certain conditions of Object Concordance.

Finally, there is some indication that relationships between variables at the group level of reference are more often significant than relationships between variables at the level of individual group members. This finding, though not definitive, is consistent with earlier results.

Relation of Findings to Other Research

It should be noted that our conceptual approach is essentially a form of "facet analysis" as developed by Guttman (1959). Parameters of data correspond to facets, and the principle of Concordance corresponds to the contiguity principle of Guttman's facet theory. The present classification system is far less sophisticated, mathematically, than facet analysis. Furthermore, the purposes for which the two methodologies were developed are quite different. Nevertheless, the results which we have obtained are in close correspondence with results reported by Foa (1958) utilizing facet analysis.

Our findings are also in accord with results obtained in substantive research programs by Bales (1960) and Borgatta (1960). Both researchers have recently reported consistent patterns of relationship among self-report judgments of individual characteristics, and among observer judgments of group interaction. At the same time, both programs failed to find consistent patterns by which the two sets of data could be related to one another. Our findings are also in accord with results reported by Fiedler and co-workers (Fiedler, Dodge, Jones and Hutchins, 1958) in their studies of interpersonal perception and adjustment. A series of self-report measures were intercorrelated, and a series of peer ratings also were intercorrelated, but there were few correlations between these two sets of data. All three of these studies are consistent with our findings. In each case, the data

for which intercorrelation patterns were obtained had Concordant Objects and Modes, while the sets of data which failed to show systematic patterns of relationship had non-Concordant Objects, Sources and/or Modes.

The apparent convergence of findings from studies carried out by a number of investigators working from diverse points of view lends support to the results of this study and their interpretation.

Interpretation of Results

Results seem most directly interpreted in terms similar to the "general systems theory" approach (Miller, 1955; Von Bertalanffy, 1955). The three main levels of reference defined by the Object parameter can be considered different system levels. With the group taken as the basic point of reference, they represent subsystem (individual member), system (group), and suprasystem (external environment). Concepts within each of these system levels tend to be interdependent, as reflected by the relatively high "batting average" for relationships between variables at the same level. The different system levels appear to be relatively independent, however, as reflected by the relatively low "batting average" for relationships between variables at different levels.

Results for the Mode parameter (state vs. action) further suggest that there may be two relatively distinct sets of phenomena within each system level, one structural and one dynamic. The structural phenomena within a given system level seem highly interdependent, as do the dynamic phenomena within each system level, as reflected by the high "batting average" for relationships with Mode Concordance and Object Concordance. However, the degree of relatedness is less between structural and dynamic phenomena, even at the same system level, as reflected by the lower "batting average" for relationships with Object Concordance and Mode non-Concordance.

This interpretation suggests that research information from the small group field can perhaps best be treated as six separate "systems" of information: a structural and a dynamic system at the individual level; comparable systems of group structure and group dynamics; and systems of structural and dynamic phenomena external to the group. These six systems are represented in Figure 5.

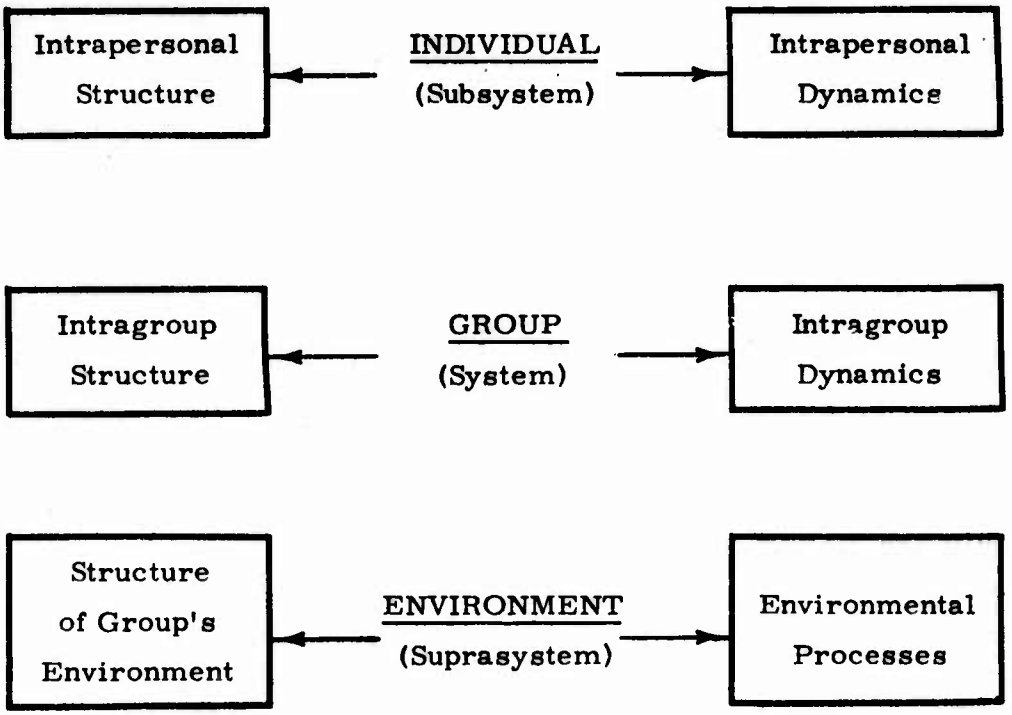
There appears to be a body of relatively well-established relationships within each of these six systems, as reflected by the relatively high "batting averages" for relationships with Concordance of both Mode and Object. However, the small group field is still weak in establishing relationships between the six "systems," even between the structural and dynamic systems at the same level of reference. This is perhaps to be expected for a relatively young field, and may be indicative of a "normal" pattern and rate of progress in the development of a scientific area.

The relatively high "batting average" obtained for intrasystem relationships implies that existing research information on small groups can be systematized as a guide for future small group research. A catalogue of the relatively well-established relationships within each system of information can be developed by a careful examination of the relationship classes which showed relatively high "batting averages," and by consideration of content-based subclasses within each of these relationship classes. A start toward this aim has already been accomplished in the form of a catalogue of major variable classes (Altman and Terauds, 1960). Results of the validation study make it possible to develop a more precise and uncomplicated catalogue by separate analyses for the six "systems" of information.

The relatively low "batting averages" obtained for cross-system relationships may be viewed as having any of several "meanings." It may mean that the separate systems are relatively independent, empirically,

FIGURE 5

DIAGRAM OF THE SIX "SYSTEMS OF INFORMATION"
WITHIN SMALL GROUP RESEARCH STUDIES



and that we must ultimately develop separate "sciences" for each. Conversely, it may be viewed as a normal pattern of development for a relatively young scientific area. Formulation of sound hypotheses may inevitably proceed from "close" to more "distant" relationships. If this is the case, then our findings merely reflect the relatively early stage of development of the field.

In either case, there is need for continued effort to try to relate phenomena from the different systems. Relationship classes involving cross-system relationships should be examined to identify particular content subclasses which have relatively high "batting averages." These may offer important clues to the basic principles by which different systems can be related to one another. Perhaps in the search for consistently significant cross-system relationships, we should relax the criterion of significance (the alpha level) or of consistency (the "batting average" which is to be considered "high"). Such a shift in the relative risks of type one and type two errors would prevent the grossness of the classification system from obscuring important though marginal evidence about cross-system relationships.

Above all, results of this study point to the crucial importance of, and the need for, broad substantive theory in the small group field. The present approach is atheoretical. Its results highlight the limitations which are inherent in any field in which research lacks an adequate theoretical underpinning. The extent to which our research program becomes a contribution to the small group field can be measured, ultimately, in terms of the extent to which our results serve as a base of information to facilitate the formulation, refinement and validation of broad substantive theory.

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