

DOCUMENT RESUME

ED 084 614

CS 500 508

AUTHOR Maffeo, Gilbert J.
TITLE The Role of Multivariate Data Analysis in Speech Communication.
PUB DATE Nov 73
NOTE 12p.; Paper presented at the Annual Meeting of the Speech Communication Assn. (59th, New York City, November 8 through 11, 1973)

EDRS PRICE MF-\$0.65 HC-\$3.29
DESCRIPTORS *Behavior Rating Scales; *Communication (Thought Transfer); Data Analysis; Evaluation Methods; *Factor Analysis; Measurement Techniques; Research Design; Research Opportunities; *Speech; *Statistical Analysis

ABSTRACT

Trends in speech communication research reflect a multidimensional view of human behavior resulting in more sophisticated methods of design and data analysis. Factor analysis, which might be considered a first step in multivariate analysis, can generate factors in speech communication studies for use as dependent variables as demonstrated through an example of the effects of seating arrangements on persuasion. An example of research on communication denial as a cause of alienation in a small group illustrates that multivariate analysis of variance might yield significant results where separate analysis of variance would not. Multivariate statistical approaches enhance opportunities for new studies or reevaluations of old studies in areas such as attitude change and small group communication because they yield more precise analyses of data. (BLB)

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

ED 084614

**THE ROLE OF MULTIVARIATE DATA ANALYSIS
IN SPEECH COMMUNICATION**

**Paper Presented at the Annual
Speech Communication Association
Convention, New York, 1973**

**Gilbert J. Maffeo
Central Michigan University**

PERMISSION TO REPRODUCE THIS COPY-
RIGHTED MATERIAL HAS BEEN GRANTED BY

Gilbert J. Maffeo

TO ERIC AND ORGANIZATIONS OPERATING
UNDER AGREEMENTS WITH THE NATIONAL IN-
STITUTE OF EDUCATION. FURTHER REPRO-
DUCTION OUTSIDE THE ERIC SYSTEM RE-
QUIRES PERMISSION OF THE COPYRIGHT
OWNER."

500 508



FILMED FROM BEST AVAILABLE COPY

"THE ROLE OF MULTIVARIATE DATA
ANALYSIS IN SPEECH COMMUNICATION"

GILBERT J. MAFFEO
CENTRAL MICHIGAN UNIVERSITY

One only has to read through the major journals in the field of Speech-Communication to realize that progress in the area of data analysis is in its infancy stage. The above observation points to the fact that growth in the methods of data analysis used in the field are just beginning to unfold. It is apparent that greater sophistication in design and statistical analysis have become the norm and precision the governing hand. This basic philosophy has given rise to another aspect of research that scholars in the field cannot ignore. There is now a growing need in the field of Speech-Communication to observe human behavior in light of man's multidimensional nature.

This approach to scientific research is by no means new to the behavioral sciences. As far back as 1904 Spearman, who originated the multivariate statistic factor analysis, recognized this problem. In dealing with intelligence, he states, "all branches of intellectual activity have in common one fundamental function (or groups of functions), whereas the remaining or specific elements of the activity seem in every case to be wholly different from that in all others."¹ Spearman like the many other men who followed him realized that man is composed of a multi-dimensional system of interrelated components. One can turn to the works of personality theorists such as Cattell² to support the idea of man's complex make up. The works of Osgood, Tennenbaum

and Succi³ support the idea of man having a number of different attitude dimensions and the work of the ethos theorists gives further verification.⁴ Recent research conducted by Tucker,⁵ Bochner,⁶ Bochner,⁷ DiSalvo,⁸ Mabry,⁹ Yerby,¹⁰ Kelly,¹¹ Ware,¹² Rubin,¹³ Maffeo,¹⁴ and Bess¹⁵ give some indication of the movement of the field toward the analysis of the multidimensional complexity of communication behaviors. If one was to survey the recent journals he would find that the Bochner and Bochner study in the November issue of Speech Monographs¹⁶ is one of the few studies utilizing the multivariate analysis of variance. This type of analysis brings new dimensions to the study of communication behavior and one can begin to view relationships between previously untested phenomena. Since further precision in communication research has been the norm, then a look at the role of multivariate data analysis merits further investigation.

According to Cooley and Lobnes, multivariate analysis can be defined as

"the branch of statistics concerned with analyzing multiple measurements that have been made on one or several samples of individuals. The important distinction is that the multiple variates are considered in combination as a system of measurement."¹⁷

One popular type of multivariate analysis used today is factor analysis. This technique has wide application in many fields and is by no means a new method. "Hundreds, perhaps thousands of cases of its application are scattered throughout the social science literature ... and it has become the calculus of such fields as sociology, psychology, and political science."¹⁸

This popular statistic can be a very valuable tool to the communi-

cation researcher. One use is the reduction of a set of scales¹⁹ in size and factoring these items into different dimension. This is the common use for factor analysis in speech communication. Once this is completed a researcher often uses each factor or at least the first factor as separate dependent variables. This technique is an acceptable way of test construction. What is advocated in this paper is that we, as researchers in the field of speech communication, begin to use these factors as dependent measures together as a system of measuring variables. A hypothetical research example may be used to elaborate the point.

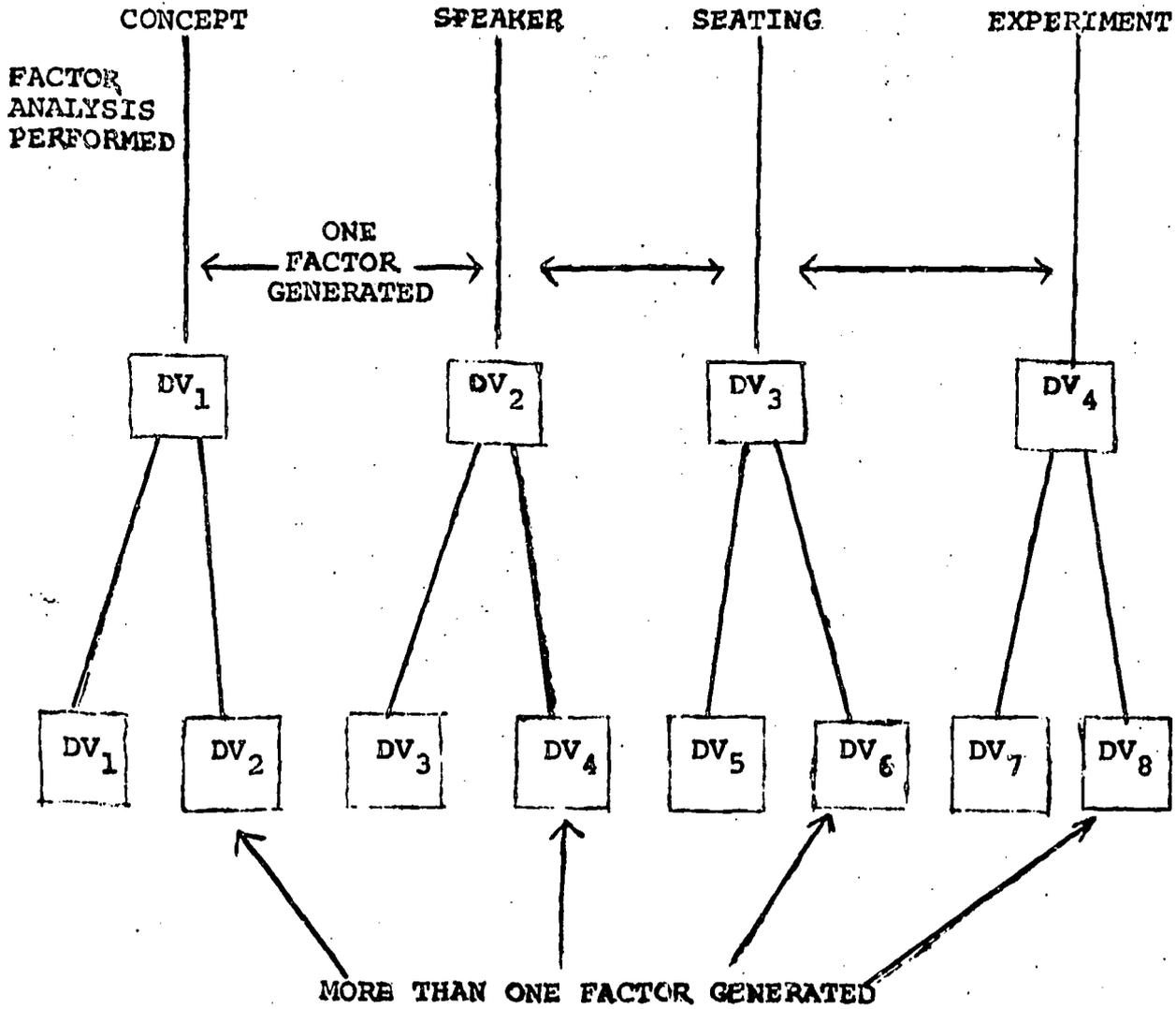
Let us say that researcher Smith is attempting to study the effect of seating arrangement on the process of persuasion. The topic used was the concept of life insurance. First the researcher develops different tests which measure attitude toward the speaker, attitude toward seating, attitude toward the concept, and attitude toward the entire experiment. The researcher then will have at his control four dependent variables that are related to one another and could be used as a system. If the factor analysis performed to develop each of these measurements generated two pure factors the researcher would end up with eight possible measurements. Figure #1 shows a graphic depiction of this.

(See page 4.)

The actual number of measuring instruments used in a multivariate analysis of variance can vary from two to what ever the researcher feels is reasonable. Factor analysis then may be considered the first step in this process of analyzing data through a multivariate technique. It must be understood, however, that factor analysis is not always needed but is used only as an example here.

FIGURE 1

SCALES FOR ATTITUDE TOWARD



After having discussed the use of factor analysis in developing multiple measures, we can go on to look at another type of analysis. A hypothetical example may be used to illustrate this point. A researcher is attempting to test the effect of "communication denial" as a cause of alienation in a small group.²⁰ The design of the study is as follows: two independent variables are utilized, Factor A (scores on the Berger Acceptance of Self and Others Test)²¹ contains two levels, high and low scores; Factor B (communication denial)²² contains three levels, selective participation, non-person status, and free communication. Subjects are randomly assigned to conditions according to their scores on the Berger test. Task groups are comprised of 4 members, three of which are confederates. The dependent variable used are two scales, one measuring isolation and another measuring powerlessness.

According to the body of literature contained in the speech journals, the usual tool employed would be the use of two separate two way analysis of variance. This would not provide the precision needed in analysis. The reasoning for this assertion can be explained through example. Let us assume a two way ANOVA was performed using the first dependent variable "isolation". The analysis performed produced a yield to be not significant, Table I on page 6.

TABLE 1

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F
Row	3.580	2	1.79	1.401
Column	6.457	2	3.228	2.528
R x C	5.060	4	1.265	.99
Error	252.85	198	1.277	
Total	267.947	206		

The researcher could then assume that the variables manipulated had little effect on subjects in the various conditions tested. To drive this point further, let us assume a second ANOV produced similar results, Table II below.

TABLE II

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F
Row	1.699	2	.849	.389
Column	0.169	2	.084	.038
R x C	7.093	4	1.773	0.813
Error	431.540	198	2.179	
Total	440.501	206		

It would be assumed, then, by the researcher that the variables manipulated had little effect on the subjects because of the inability to yield significance.

The point of question here is that the variables manipulated may have some effect when measured through the use of the two dependent variables as a system. If, for example, a multivariate analysis of variance was employed significance may have been attained. To take the example one step further, a look at a possible MVA yield is in order.

TABLE III
MULTIVARIATE TEST OF EQUALITY OF MEAN VECTORS

Hypothesis	Degrees of Freedom	F Ratio	P Less Than
A	3 and 93	4.876	.05
B	15 and 258	6.02	.05
A x B	15 and 258	1.04	n.s.

Two Way Multivariate Analysis of Variance.

It is entirely possible for a researcher to find significance through the use of a multivariate analysis. In this case the two dependent measures are strengthened when working as a system, therefore giving a more accurate yield. Separate analysis viewed only parts of an integrated system. It is entirely possible to have one analysis of variance yield significance and another not. It is also possible to gain significant yields in separate analysis of variance while finding no significance in a multivariate test. Regardless of the yield, the multivariate analysis is more precise and gives greater information.

The above example and information demonstrates that this type of analysis has a legitimate place in speech communication.

The use of this tool can only enhance the field. Studies utilizing the multivariate technique will help the field expand and begin to explore previously untapped areas of research. For example in many attitude change studies researchers may now test subjects on a series of related attitude tests used as a system. In the past this was done through the use of separate univariate procedures. The field of small group communication has been criticized in the past because researchers would utilize different measures, not generalizable from one study to the next. DiSalvo stated: "The use of multivariate data analysis while taking into consideration the correlation between the dependent variables, would help the researcher determine which dependent variables were consistently detecting significant differences between various treatment groups."²³ The small group researcher would be able to utilize entire systems of measurements rather than previously established single measures. This approach may be the very method that brings together a great deal of the literature in small group research.

Multivariate data analysis can only improve what already exists in the body of communication research. Eventually all Speech Communication scholars will have to face the problem of re-evaluating existing theories and updating their research methods. Univariate analysis has served its purpose and still continues to do so, but advancing the field can be more effective only when research reflects the character of its theoretical literature.

FOOTNOTES

1. George A. Ferguson, Statistical Analysis in Psychology and Education (New York, 1971) p. 404.
2. Raymond B. Cattell, ed. Handbook of Multivariate Experimental Psychology, (Chicago, 1966).
3. Charles Osgood, George Succi, and Percy Tennenbaum, The Measurement of Meaning (Urbana, 1957).
4. Kenneth Anderson and Theodore Clevenger, "A Summary of Experimental Research in Ethos," The Rhetoric of Our Times, ed. J. Jeffery Auer (New York, 1969), pp. 127-151.
5. Special thanks is given to Dr. Raymond K. Tucker of Bowling Green State University for his never ending energy in guiding the present author in the area of multivariate data analysis.
6. Arthur Bochner, A Multivariate Investigation of Machiavellianism and Task Structure in Four-Man Groups, unpublished dissertation, Bowling Green State University, 1971.
7. Brenda Bochner, Language and Value Judgements: An Experimental Study, unpublished thesis, Bowling Green State University, 1971.
8. Vince DiSalvo, A Multivariate Analysis of Variance Investigation of the Effects of Information Processing Ability, Amount of Task Relevant Information, and Group Climate on Group Behavior, unpublished dissertation, Bowling Green State University, 1971.
9. Edward Mabry, A Test of the Phase Pattern Model for Small Task Oriented Group Discussion, unpublished dissertation, Bowling Green State University, 1972.
10. Janet Yerby, Female Leadership in Small Problem Solving Groups, unpublished dissertation, Bowling Green State University, 1972.
11. Clifford Kelly, A Multivariate Analysis of Task Structure, Transparency and Interpersonal Attraction in Small Groups, unpublished dissertation, Bowling Green State University, 1972.
12. Paul D. Ware, Heckling as Distraction: An Experimental Study of Its Effect on Source Credibility, unpublished dissertation, Bowling Green State University, 1972.

13. Gary N. Rubin, A Naturalistic Study in Proxemics: Seating Arrangement and Its Effect on Interaction, Performance, and Behavior, unpublished dissertation, Bowling Green State University, 1972.
14. Gilbert J. Maffeo, The Variable of Proxemics in Audience Persuasion: A Multivariate Experimental Study, unpublished dissertation, Bowling Green State University, 1972.
15. Fred Bess and Gil Maffeo, "Scales for the Measurement of Attitudes Toward Hearing Loss", unpublished manuscript, Central Michigan University, 1973.
16. Arthur Bochner and Brenda Bochner, "A Multivariate Investigation of Machiavellianism and Task Structure in Four-Man Groups," Speech Monographs, 39 (November, 1972), pp. 277-285.
17. William Cooley and Paul Lobnes, Multivariate Data Analysis (New York, 1971) p. 3.
18. R. J. Rummel, Applied Factor Analysis (Evanston, 1970) p. 4.
19. Jum C. Nunnally, Psychometric Theory (New York, 1967) p. 289.
20. Gilbert Maffeo and Paul Wane, "Acceptance of Self and Others, Communication Denial and Alienation: An Experimental Study," unpublished manuscript, Bowling Green State University, 1971.
21. Emmanuel Berger "Acceptance of Self and Others" in Scales for the Measurement of Attitudes, ed. Marvin Shaw and Jack Wright (New York: McGraw-Hill, 1967), pp. 432-436.
22. Kim Giffin, "Social Alienation by Communication Denial," Quarterly Journal of Speech, 56 (December, 1970), pp. 347-357.
23. Vince DiSlavo and Delmer Hilyard, "A Multivariate Analysis of Variance Investigation of Small Group Behavior," paper presented at the SCA Convention, San Francisco, 1971.

RECOMMENDED READINGS

- Boch, R. Darrel. Multivariate Statistical Methods in Behavioral Research. Chicago: University of Chicago, 1971, unpublished manuscript.
- Cattell, Raymond B. (ed). Handbook of Multivariate Experimental Psychology. Chicago: Rand McNally, 1966.
- Cooley, William and Lobnes, Paul. Multivariate Data Analysis. New York: John Wiley, 1971.
- Dixon, W. J. BMD Biomedical Computer Programs and X Series Supplement. Berkeley: The University of California Press, 1971.
- Ferguson, George. Statistical Analysis in Psychology and Education. New York: McGraw-Hill, 1971.
- Finn, Jeremy. Fortran Program for Multivariate and Univariate Analysis of Variance, Covariance, Canonical Correlation and Regression. Ann Arbor: Education Research Publications, 1971.
- Morrison, Donald F. Multivariate Statistical Methods. New York: McGraw-Hill, 1967.
- Nunnally, Jum. Psychometric Theory. New York: McGraw-Hill, 1967.
- Overall, John and Klett, James. Applied Multivariate Analysis. New York: McGraw-Hill, 1972.
- Popham, W. James. Education Statistics: Use and Interpretation. New York: Harper and Row, 1973.
- Rummell, R. J. Applied Factor Analysis. Evanston: Northwestern University Press, 1970.
- Tatsuoka, Maurice. Multivariate Analysis: Techniques for Education and Psychological Research. New York: John Wiley, 1971.
- Winer, B. J. Statistical Principles in Experimental Design. New York: McGraw-Hill, 1971.