A PARADIGM FOR MASS COMMUNICATION RESEARCH

Joseph Woelfel

and
George A. Barnett

Department of Communication

Michigan State University

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I: The Problem of Media Effects

It is a common hypothesis among historians of science (particularly social science) that the impetus toward scientific scrutiny of social processes is generally spared by major changes in those phenomena. Clearly the central focus of social thought across all social sciences during the modern period has been the set of changes in social life emerging out of the scientific, industrial and technological revolution which has so fundamentally modified Western civilization over the last several centuries. The fundamental changes in communication processes following from this revolution, particularly in the light of the development only recently of truly "mass media" are, of course, a part of this overall change, and must be understood within this context as both a consequence of prior changes and themselves a source of subsequent social change.

Most sociologists, anthropologists and others whose interests lie in a macrocosmic level find it convenient to characterize societies as sets of individuals (or other social units like families or other organizations) organized such that their activities form a coherent, complimentary pattern beneficial to the survival of the society as a whole. Each individual (or social unit) occupies a location or status in that society, and as an incumbent of that status receives information about (i.e., is "socialized into") the pattern of activities expected of occupants of that status. The overall pattern of interrelations--particularly the intercommunication patterns--among these statuses are generally referred to as the social structure of the society, and the collective body of expectation for the performances of the social units along with other basid definitions, beliefs and cognitive elements of the society are usually referred to as its culture (see Gillham, 1972).

Within this paradigm, the role played by communication processes, from face-to-face interpersonal communication to large-scale mass media, is utterly fundamental; since any important change in the process by which information is transmitted through the society affects both the structure of that society and its cultural belief system in a fundamental way. Insofar as the growth and development of mass media change the intercommunication patterns of a society the modify its social structure directly by changing the interorganizational pattern of its elements; and insofar as these altered information distribution patterns distribute information differently throughout the society, they result in changed patterns of expectations, performances and beliefs which in turn constitute changes in the culture or cognitive belief pattern of the society (McLuhan, 1964).

The centuries-long analysis of the changes comprising the industrial revolution has identified several as characteric: (1) A staady and accelerating increase in population, beginning as early as the 13th Century, which facilitated the breakdown of the European land tenure system and the disruption of extended family systems contingent on that system; (2) Consequent high levels of geographic and social mobility that further disrupted historically stable interpersonal communication systems; (3) A rapid growth in technological needs and abilities, paralleling a rapid extension of formal educational systems, which further reduced interfamiliar communication networks, and (4) a development of the technical apparatus favoring the development of large scale mass communication systems. In the light of these developments, the industrial revolution can be seen as well to be a revolution in the communication structure of society, and the effects of mass communication must be understood in this larger context.

Depending on the perspective of the researcher, investigation may thus focus on the effects of mass communication on the social structure of the society,

or on its culture. Again, depending on the perspective of the observer, these effects may be assessed from the point of view of the individual or for the society taken as a whole. Within either the individualistic or the collective approach, it is further possible to consider specific effects of mass communications appeals or more global effects. These various approaches are reflected in the research concerns of investigators in the area, and are represented in tabular fashion in Diagram one.

Cell 1a of Diagram one represents the specific change in element of an individual's social structure as a result of a change in media exposure, such as an increase or decrease in the amount of time spent exposed to, say, a radio advertising campaign. Cell 1b represents changes in some specific cognitive element of an individual like an attitude, as a result of some media process. Generally, Cells 1a and 1b are considered jointly in the same studies, and changes in some specific attitude or behavior (like voting preferences or attitudes toward some commercial product) are related to variations in exposure to some media campaign. (Katz & Lazarsfeld, 1954; Berelson, Lazarsfeld & McPhee, 1954; Woelfel, et al., 1970, 1974). In most recent studies, single attitudes (like attitudes toward some political view) are hypothesized to be simple linear aggregates of a set of influences, among which are messages via mass media, of the general form:

$$A = \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n + e$$

Cell 2a represents the effects of changes in mass communication variables on the global organization of an individual's communication network. It differs from cell 1a in that it represents concern with the impact of mass media on the overall communication system within which an individual is located, rather than with changes in some specific element of that system (like, for example, radio use).

Cell 2b represents the effects of mass media over the global cognitive structure of the individual. Such research concerns itself with overall effects of media on the self-concept of the individual rather than on some specific attitude component.

Rows 3 and 4 of figure five represent a change from the individual as unit of analysis to the aggregate or society as a whole. Thus cell 3a, for example, represents effects of media on some specific element of the overall social structure, as, for example, research into the change of prime time viewing habits of the nation. Correspondingly, Cell 3b represents the effects of media on some individual component of the culture itself, as, for example, a change in the percentage of persons believing the president is doing a good job.

Cells 4a and 4b represent the highest and most comprehensive considerations of media effects. Cell 4a considers the global effects of mass communication systems on the overall social structure, including, for example, the consequences of mass media on family, religious, economic, recreational and other institutionalyzed structures of the society. Typical of these researchers are those concerned with the "massification" of populations by mass media. Cell 4a considers the global effects of mass communication systems on the overall cultural belief patterns of society and thus reflects an interest in the effects of changes in the structure of communication systems on the overall Weltanshaving or Zeitgeist of a society.

While communications scholars have expressed interest in each of these questions, empirical researchers on the global effects of mass communication systems over the aggregate cultural beliefs of society (Cell 4b) are absent, leaving sucy analyses to the speculations of sociologists, philosophers, historicans and other interests in macro-level social processes. McLuhan (1964) is a classic example.

This absence of extensive empirical research into this centrally important question can probably be attributed in the largest part to its sheer difficulty, particularly the difficulty of segregating the effects of communication systems on cultural beliefs from other potential causal agents developing as a part of the same social revolution which gave rize to the media, although the advent of path-analytic procedures for causal analysis of ongoing social processes offers great promise for such analyses. Equally formidible, however, as a barrier to research is the absence up until now of precise measurement procedures for the analysis of cultural change on a global level. This paper represents an attempt to provide both a theory and measurement system for the description and analysis of cultural changes on a global level.

II. Theory--The Measurement of Cultural Definitions

The process of definition is a process of relating objects of thought to each other. The definition of any concept may be taken to be that term's relationship to all the other concepts which are used to differentiate that referent as a unique object. (Fillenbaum and Rapoport, 1971.) Fundamentally this involves taking note of similarities and differences between objects, or identifying the attributes of an object with similar attributes of different objects, and differentiating the attributes of the object from those attributes of the objects' which are different.

The perception of a single object as a single object implies a process of categorization in that all the discrete stimuli which constitute the physiological mechanism of that perception are set apart from the totality of stimuli impinging on the organism at the time and designated as a single object of thought. The category renders discrete what is really a continuous process of exposure to

stimulation by the environment, whereby an arbitrary segment of a continuum of stimulation is set aside and referred to as "a perception."

When an individual identifies two objects as "yellow," for example, this classification does not imply that he or she perceives them to be the same, even with regard to color, but simply similar enough to warrant description by means of the same linguistic category. The visual color spectrum generally covers the range from about 4000 to 6400 Angstrom units, and research indicates that color differences of only a few Angstrom units are perceivable, yet ordinary language does not provide color terms for all these differences. Thus the ordinary language people speak (and for the most part the language of social science) allows only a crudely approximate description of the perception of color and likewise any other object.

Mathematics provides a language capable of describing differences small without limit, and can describe differences much smaller than may be discriminated by human perceptual apparatus. The continuous set of positive real numbers offers a potentially error-free language for the definition of any set of social objects with a level of precision for greater than the limits imposed by human chemical sensory apparatus.

Dissimilarities among objects (whatever those objects may be) may be represented by a continuous numbering system such that two objects considered to be completely identical are assigned a paired dissimilarity score or distance score of zero (0), and objects of increasing dissimilarity are represented by numbers of increasing value. Assuming that the definition of an object or concept is constituted by the pattern of its relationship to other objects, the definition of any object may be represented by a 1Xn vector, d_{11}, d_{12}, d_{13},...d_{1n}, where d_{11} represents the distance or dissimilarity of object 1 from itself (thus d_{11}=0

by definition), d_{12} represents the distance or dissimilarity between objects 1 and 2, and d_{1n} represents the distance between the 1st and the nth objects. Similarly, the second object may be represented by a second vector, d_{21}, d_{22}, $d_{23},\ldots,d_{2n}$, and the definition of any set of concepts or objects may therefore be represented in terms of the matrix

$$\begin{matrix} d_{11}, & d_{12},\ldots, & d_{1n} \\ d_{21}, & d_{22},\ldots, & d_{2n} \\ \vdots & \vdots & \vdots \\ d_{n1}, & d_{n2},\ldots, & d_{nn} \end{matrix}$$

where any entry d_{ij} represents the dissimilarity or distance between i and j.

The distance matrix D, provides a static picture of the interrelationships among a set of N objects at any one point in time possessed by a single individual. Process can be recorded in successive matrices D_{to}, $D_{t1},\ldots,D_{tn}$, where the intervals between time periods 0, 1, 2,...N, remains constant,* and the changes between the matrices calculated. These intervals can be made as small as desired to increase the isomorphism with the continuous nature of the notion of process. Since this paper is concerned with social systems rather than single individuals, the matrices must be generated for an entire culture.

It is the position of this work that the collective consciousness (Durkheim, 1951), i.e., that aggregate psychological configuration which constitutes the culture of a society and toward which individual beliefs may be seen to tend, may be represented accurately as the average matrix $\bar{D}$, where any entry $\bar{d}_{ij}$ is the arithmetic mean conception of the distances or dissimilarities between objects i or j as seen by all members of the culture.

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*If the time intervals between measurements are unequal, but they are known, the same information may be gained. However, a more complicated analysis is required.

What has emerged then, is a cultural definition of a set of concepts, in matrix format, dynamic in the sense that successive matrices can be generated to measure change over time. The difference $\overline{D}_{t1} - \overline{D}_{t0}$ would represent the cultural change taking place over the interval from t0 to t1. The rate at which any culture is changing can be found by the derivitive

$$\lim_{t1 - t0 \to 0} \frac{D_{t1} - D_{t0}}{t1 - t0}$$

While this matrix is an accurate representation of a set of cultural definitions, it is extremely cumbersome due to its size. The matrix is of order N, where N equals the number of concepts. N-1 is the maximum total number of dimensions used by the sum of the individuals of a society to differentiate the set of objects. This is not the dimensions shared by the members of the culture. Matrix $\overline{D}$ describes an implicit vector space V_k, where k (the dimensionality of the space) $\leq$ N-1. K equals the number of shared dimensions upon which the members of society differentiate the objects.

V_k, is a spatial coordinate system defined by the distance relations among the cognitive objects which are its contents. It has as a minumum the property that objects defined as similar by any culture will be located close to each other in the space, or, more precisely, that the distance between any pair of objects in the space is directly proportional to their perceived dissimilarity. The precise definition of any objects, therefore, is given by its location in V_k, and, as a corollary, any change of definition of any object is represented by its movement through V_k.

Matrix $\overline{D}$ may be collapsed to vector space V_k. This has the advantages of reducing the data to usable proportions and revealing the uniquely shared underlying cultural dimensions. This task can be performed by multidimensional scaling.

According to Helm, Messick and Tucker (1959:14):

> The fundamental concept in multidimensional scaling is psychological distance, which is usually estimated in terms of judgements of similarity among stimuli; i.e., two stimuli judged to be very similar are considered to be psychologically closer together than two stimuli judged to be very different. Given judgements of similarity among all the stimuli in a set, mathematical models exist which provide an interpretation of these psychological distance in terms of Euclidean geometry. The stimuli are treated as points in a Euclidean space, and analytical techniques are available to obtain the dimensionality of the space as well as stimulus scale values determined within a rotation and translation.

Multidimensional scaling models can be used in situations where the stimuli may vary simultaneously with respect to several underlying dimensions or attributes. According to Warren G. Torgerson (1958:248):

> The notion of a single unidimensional, underlying continuum is replaced by the notion of an underlying multidimensional space. Instead of considering the stimuli to be represented by points along a single dimension, the stimuli are represented by points in a space of several dimensions. Instead of assigning a single number (scale value) to represent the position of the point along the dimension, as many numbers are assigned to each stimulus as there are independent dimensions in the relevant multidimensional space. Each number corresponds to the projections (scale value) of the points on one of the axes (dimensions) of the space.

The process is analogous to converting a matrix of city to city mileages to a graphic representation such as the map itself. In this special case, an n x n table of cities may be reduced to a 2-dimensional plot.

It is not a distance between cognitive objects in some abstract sense which is to be measured, but perceived distance; i.e., the judgements of distances made by individuals and cultures. Consequently, what is needed are judgements of dissimilarities among objects made by respondents but expressed as ratios to some standard unit provided by the experimenter. This can be accomplished quite directly by a question worded in the form:

"If x and y are u units apart, how far apart are a and b?"

Such an item wording requests a dissimilarities judgement from a respondent ("...how far apart are a and b?"), but requests that this judgement be made as a proportion of a standard distance provided by the experimenter ("If x and y are u units apart...").

This technique has several key advantages: First and foremost, no restrictions are placed upon the respondent, who may report any positive real value whatever for any pair. Thus the scale is unbounded at the high end and continuous across its entire range. Secondly, because the unit of measure is always the same (i.e., the unit is provided by the investigator in the conditional, "If x and y are u units apart," and thus every scale unit is $\frac{1}{u}$ units), and because the condition of zero distance represents identity between concepts and is hence a true zero, not at all arbitrary, this scale is what social-scientists usually call a ratio scale, which allows the full range of standard arithmetic operations. Third, since the unit of measure is provided by the experimenter it is possible to maintain the same unit of measure from one measurement to another, both across samples and across time periods, which is crucially importance since time is one of the primitive variables of scientific theory. These three characteristics taken together provide the capacity for comparative and time-series analyses at very high levels of precision.

While the technique suggested meets the criterion for scaling quite exactly, and in fact will be the technique of choice in the measurement of aggregate cultural patterns, problem of unreliability make it unsuitable for the measurement of individual self-conceptions. It is axiomatic in psychometrics that the reliability of any scale is approximately proportional to the degree to which the scale is structured and inversely proportional to the complexity of the judgemental task required of the respondent. The technique of direct paired

distance estimates requires a highly complex set of judgements from the respondent while providing virtually no structure, and is consequently unreliable for measurement of individual psychological contents (typical test-retest reliability correlations range in the .70's). Barnett (1972) and Gillham (1972) have shown that the format is extremely reliable on large samples and that consistency of measure increases as a function of sample size. The reason for this is that because of the law of large numbers, the mean value of the distance estimates become increasingly stable as sample size increases. Thus, reliable measurement becomes only a function of the cost of gathering additional cases.

Obtaining the underlying vector space from the matrix $\overline{D}$ is straightforward.* Procedurally, the data collection outlined earlier yields a three-dimensional concepts x concepts x person matrix which is averaged across the $\underline{n}$ persons into a two dimensional concepts x concepts square symmetric matrix $\overline{D}$, where any entry $\overline{d}_{ij}$ represents the average distance between concepts $\underline{i}$ and $\underline{j}$ as seen by the respondents. This matrix $\overline{D}$ is transformed routinely into a scalar products matrix B* (Young and Householder, 1938), although it is generally the practice of investigators to "double-center" this matrix by establishing an origin for the space at the centroid of the distribution. This can be done simply during the construction of the scalar products matrix, and the transformation for any cell b_{ij} is given by the equation

$$b^*_{ij} = 1/2 \left(\frac{\sum_{i=1}^{n} d^2_{ij}}{n} + \frac{\sum_{j=1}^{n} d^2_{ij}}{n} - \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} d^2_{ij}}{n^2} - d^2_{ij} \right)$$

*The technique outlined in the following pages is based on the classical multi-dimensional scaling model well known to psychometricians (see Torgerson, 1958). Other non-metric scaling models are available, but these techniques apply principally to the reduction of matrices which are merely ordinal, and so are not applicable to the continuous, reliable, ratio scaled data provided by the measurement system proposed in this article. See particularly Shephard (1966).

which is straightforward linear transformation that sacrifices none of the information present in the original matrix D (Torgerson, 1958).

This new centroid scalar products matrix is such that any entry:

$$b^*_{ij} = p_i p_j \cos_{ij} \qquad \text{where} \qquad \begin{aligned} p_i &= \text{the length of vector } \underline{i} \\ p_j &= \text{the length of vector } \underline{j} \\ \partial ij &= \text{the angle between } \underline{i} \text{ and } \underline{j} \end{aligned}$$

Consequently, when this matrix B* is reduced to its base by routine factorization (i.e., the application of any standard eigen routine, such as principal axis or jacobi), the result is a factor matrix F, whose columns F_1, F_2, ... F_k are orthogonal vectors with their origin at the centroid of the vector space spanned by F and where any entry F_{ij} represents the projection (loading) of the ith variable on the jth factor. This matrix has the further properties such that:

$$p_i = \sqrt{\sum_{j=1}^{k} d^2_{ij}}$$

That is, the square root of the sum of squared projections of the ith variable across all the k factors equals the length of the vector of the ith variable, and of central concern:

$$\overline{d}_{ij} = \sqrt{\sum_{f=1}^{k} (d_{if} - d_{jf})^2}$$

This last expressions shows that the original distance matrix can be completely recovered from the factor matrix with no loss of information.

After a series of vector spaces has been generated at separate points in time, they can be rotated to a least square best fit congruence in order to calculate the change over time.

By the simple subtraction of coordinates over time, motions through the spatial manifold over time may be expressed as velocities, as given by:

$$V_1 = \frac{d_i}{t} = \sqrt{\frac{\sum_{j=1}^{m} (a_{ij} - b_{ij})^2}{t_1 - t_0}}$$

where V_i = the velocity of concept i

d_i = the distance concept i has moved across the interval of time t

t = time

a_j = the coordinate value of concept i on the jth factor of the t_0 space

b_j = the coordinate value of concept i on the jth factor of the t_1 space

and given multiple time periods, as accelerations:

$$\overline{A} = \frac{\Delta V_i}{\Delta t}$$

These velocities and accelerations, the necessary component of process (Arundale, 1971, 1973), are unmistakably measures of cultural change of very high precision. This is so, since the culturally shared definition of any object is given by its location in the manifold V_k, and changes in location represent changes in definition.*

Several attributes are unidimensional, among them; weight and length. Spatial position, however, varies along three dimensions, height, length, and width. Spatial position on the surface of the earth is also measured with three dimensions; altitude, longitude and lattitude. Knowledge of the position of an object along any one or two dimensions will not locate it precisely in the space. All three dimensions must be known. Likewise, color is said to possess several underlying qualities. The color green can vary simultaneously according to hue, chroma and any other of several different qualities.

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*A Fortran IV computer program (Serota, 1974) which accomplishes the principle calculations described in this article is available from the author on request.

Multidimensional scaling has been used in the past to investigate the dimensions underlying personality (Klingburg, 1941; Wish, 1970), the meaning of lexical items (Cliff, Pennell and Young, 1966; Henley, 1969; George A. Miller, 1969; Fillenbaum and Rapoport, 1971), the perception of speech sounds (Miller and Nicely, 1955; Degerman, 1972), and the processing of information (Schroder, Driver and Streufert, 1967; Rips, Shoben and Smith, 1973; Rumelhart and Abrahamson, 1973). Data for these studies were all collected by methods which were non-metric in nature. They used a method of triad combinations, where the subjects were given three stimuli and asked to report which two were more similar; or a method of pair comparisons, where the subjects were told to record the similarity of the pair on a discrete Likert-type scale whose range was very limited, nine points at the most; or the proportion of responses who selected a pair as being the correct relation.

III. A Sample Research Project

Mass communication research has by-and-large failed to consistantly demonstrate that the media have direct effects on the attitudes of their users (Klapper, 1960, 1970; Weiss, 1969). Two possible reasons for this are the lack of sensitive measurement tools and the preponderance of research designs borrowed from Sociology and Psychology which are antiprocessual in nature. Typically, an individual's attitudes are measured only once and the results correlated with exposure patterns to imply a cause and effect relation. Or, the subjects' attitude may be measured twice, once prior to a single exposure of some valenced stimulus and once directly after. This trend recently has shown some signs of changing with researchers adopting path analytical tools to describe the communication process.

Metric multidimensional scaling provides a measurement tool sensitive enough to detect the effect of messages and as indicated above, it is ideally suited to assess global changes over time due to the impact of a series of media messages.

If one were interested in the effects of political advertising, they might adopt a research design as follows:

Generate MDS spaces for a number of different social systems at six or more equal intervals in time; three points prior to an advertising campaign, at least one during and two after. The reason for the large number of observations is to gain data on the variation of the rate of change over time (acceleration).* This may be positive or negative. In order to gain information about acceleration three points are the necessary minimum. These must be gained prior the the manipulation in order to determine the "natural" acceleration of the system. At least one measurement would be taken during the manipulation. Additional data points may be collected during the advertising campaign in order to determine the rates at which attitudes toward the candidates change. Two measurements should be made after the treatment to observe the change in the rate due to the alterations of the society. These rates of change can be found by determining the change in the slopes (derivatives) between each measurement point.

Ordinarily, only four measurements are sufficient to determine changes in acceleration. However, when dealing with long term effects, as with political behavior, additional measures become necessary. Are the people adopting the candidate or are they only going through a trial period? Is their "permanent" cultural change occurring or only short-term alterations in the cultural definitions? Another advantage of having at least two readings after the manipulation is to control for the effects of maturation. Was the system change caused by the

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*A necessary condition for the discussion of process (Arundale, 1971, 1973).

manipulation or was it produced by some other factors at the identical time (Campbell and Stanley, 1963: 37-42)?

Data would be gathered from a series of treatment groups, each subject to a media campaign in which the message is held constant but the channel is varied. The same message would appear in or be heard on only one medium, television, radio, newspapers or magazines, or some controlled combination of these media. In this way, it becomes possible to measure the independent effects of each separate medium and the possible interaction effects when they have been used in combination. The separate groups could be cities matched by their size, past voting patterns, the S.E.S. of the residents, their use of the media and any other relevant variables. In addition, there should be a comparable control group in which no media campaign would take place.

Data would be gathered from separate random samples* of registered voters (as opposed to a panel design) at each point in time so as to avoid sensitization, a potentially destructive problem with such a large number of measurements. Typically panel designs have been recommended to measure the effects of the media on voting behavior (Lazarsfeld, Berelson and Gaudet, 1944; Berelson, Lazarsfeld, and McPhee, 1954). However, since the unit of analysis proposed is not the individual but the culture of the respective social system, it makes little sense to use the same subjects in light of sensitivity and mortality.

The spaces would be generated by having the subjects perform distance estimates on pairs of concepts which are of interest. For example, if a presidential candidate were one subject matter, then estimates could be made between the

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*These samples could vary in size from 100 to 400 cases depending on the level of reliability the researcher wishes. Thus, the cities chosen should have a minimum population of at least 50,000. Again, this may vary depending on the number of administration collected and the need for a matched set of cities.

following concepts: trustworthy, competent, experience, warmth, honesty, my vote, a number of different candidates' names including the one which is the subject matter of the advertising campaign, a number of issues and any other related notions.

Past research on attitude change would point towards one additional control, the number of messages (number of advertisements) transmitted. A number of researchers (Woelfel and Hernandez, 1970; Woelfel and Saltiel, 1974; Metlin, 1973; and Mistretta, Miles and Barnett, 1973) have found that movement in space (in the unidimensional case) is related to the absolute number of messages the subject receives. In each case, the dependent variables was measures as a rate of behavior, such as the number of cigarettes smoked per day. This would suggest that one should control not only the content of the messages but their number as well.

The experimental manipulation could be a "standard" advertising campaign dealing with a known candidate. The reason for using an established candidate is that it would be impossible to generate the vector space if one concept were entirely unknown. This would go on for a designated time period in each of the sample sites.

After all cultural conceptual spaces have been generated, they would be rotated to congruence and the change scores and the rates of change of the entire space calculated. Then the rates can be compared to see which medium was most effective in altering the subjects' attitudes toward the candidate. This analysis could point toward two interesting questions. Which medium was most effective in achieving an immediate response to the candidate? And, which method of advertising had the greatest staying power, i.e., producing the longest lasting effects?

It is also possible to observe change of the individual concepts in the space in order to determine how effective the campaign was at altering that term's definition or its rate of change. For example, if the goal of the ads were to promote a certain candidate, then one would be interested in the movement of that person in relation to the others in the space. At what rate does the candidate converge with the concept, my vote and is this rate greater than the other candidates in the space?

It is also possible to validate the movements in the space by comparing the rates of change with behavioral indicators, such as voting behavior or more typical attitude measures such as poll data. One could calculate the rates of change in poll data by measuring the slopes between any two points in time. These could then by compared with the slopes produced by the various media and the one or combination of channels which most highly correlated with the poll data would seem to be the most effective.* That is the one with the highest degree of correspondence between its exposure and the attitude change produced. This should not be confused with the behavioral indicator, voting. In that case, the medium which produces the greatest increment in voting for the candidate may be considered the most effective. While the use of actual voting data has pragmatic value, it should be avoided in a discussion of the effects of the media because it is only a single dichotomous decision at one isolated point in time by a restricted portion of the population, that which is actually voting.

IV. A Truncated Empirical Example

The authors along with Martin Mistretta and William Miles, collected an example of a set of data at the University of Illinois (Urbana) during the

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*This, of course, does not include the variable cost. While television (or some other medium) may be the single most effective medium in altering socially held attitudes, its rate of change per unit cost may make it less desirable.

Spring of 1972. It dealt with students' definitions of social problems. The researchers had intended to measure the effect of "Earth Week" by observing the movement of 15 scaled concepts at three points in time. The measurements were intended to occur once prior to Earth Week, one measurement during the week and one after the event. Specifically, the study was designed to predict the movement in the space as a function of mass media and interpersonal information that the student received about environmental topics.

Distance estimates were performed on the 105 pairs generated from the 15 following concepts, presented to the subjects in random order. A copy of a portion of the questionnaire is located at the rear of the paper.

1. Overpopulation
2. The War in Viet Nam
3. Public Transportation
4. Capitalism
5. The Most Serious National Problem
6. Automobiles
7. Air Pollution
8. Socialism
9. Noise Pollution
10. Environmental Protection
11. Pesticides
12. Crime
13. Water Pollution
14. Conservation
15. Recycling Resources

The sample consisted of 110 students enrolled in an introductory Sociology class. There were 61 matched cases, subjects who completed the questionnaire for all three administrations. The sample consisted of 31 males and 30 females. Their mean age was 18.8 years and they had completed on an average of 0.85 years of college. Their self perception of their political identification was 2.90 on a five-point scale where one represented radical right and five was left-revolutionary. Clearly, they were moderates.

Data were gathered on April 14, April 28, and May 19, 1972. Due to the impact of unanticipated social events, the results can be discussed only serendipitously.

On April 16, the Defense Department announced the bombing of Haiphong, North Viet Nam and the mining of that city's harbor. On April 19, the University

of Illinois was besieged with heavy rioting in protest of the government's bellicose policies. The windows of the stores in the adjacent business district were broken and there was considerable looting. This continued for a number of days, despite the presence of the state police. The planned environmental programs were suspended or ignored. Between the second and the third data points, Governor George C. Wallace was shot while campaigning in Maryland (May 15). Thus, there was a great deal of information made available to the subjects about certain concepts, that were scaled in the space. They were the War in Viet Nam, Crime and the Most Serious National Problem. Additional information about these topics was made available in open educational forums and leaflets which discussed the issues. There was little information concerning the majority of the ecological topics. This may be compounded by the fact that the majority of the subjects were college freshmen experiencing a campus upheaval and its information bi-products for the first time.

Results:

The mean distance matrices for each point in time are presented in Tables 1, 2 and 3. The spatial coordinates matrices for each point in time are presented in Tables 4, 5, and 6. A three dimensional solution was found in each case. These three coordinates systems were then rotated to a least-square best fit congruence and then the graphic representations (Figure 1, 2 and 3) plotted. The correlations between the axies over time are presented in Table 7. They provide an indication of the quality of the solution. Finally, all three spaces were graphed together to produce a plot of the concepts' trajectories over time.

In regards to the movement of the key concepts, the war in Viet Nam moved 6.78 units between the first two measures, while crime moved 4.86 and the Most Serious National Problem (M.S.N.P.) 5.71, as compared to the mean movement of

all concepts, 4.18 units. Between the second and the third measures, the war moved 11.05 units, crime 7.69 and M.S.N.P., 6.87. The mean was 5.22 units. These concepts moved to a greater extent than the environmental terms scaled in the same space. They were redefined to a greater degree than the environmental terms. Perhaps, this was due to the additional information the subjects received about these concepts.

The extent of redefinition becomes more profound when examining the plot of the concepts' trajectories. Both the war and crime moved in the direction of the Most Serious National Problem. The war seemed to be lagging behind the M.S.N.P. The war's time two location is near the point of the time one definition of M.S.N.P. Crime follows a similar pattern of movement. While there is movement of the other terms, it is difficult to assign direction to them. They do appear to move toward the original time one position between time two and three.

These findings clearly lack the rigor necessary to test the hypothesis that movement in the space is a function of the amount of information the subjects receive. This finding is only implied by the results. In order to test that hypothesis, one would need to control the information concerning the scaled concepts or perform a content analysis about those topics.

Diagram 1

		Structure	Cognitive Elements
Individual	Particular	Media Use Patterns 1a	Attitude Change 1b
	Global	Change In Intercommunication 2a	Personality Self Perception 2b
Aggregate	Particular	Percent Per Capita Of Media Use 3a	Collective Attitudes Issues 3b
	Global	Massification Change In Social Communication 4a	Metric Multidimensional Scaling--The Galileo Techniques 4b

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