DOCUMENT RESUME

ED 333 522 CS 507 505

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TITLE Time and Process in Message Processing Literature.
PUB DATE May 91
NOTE 38p.; Paper presented at the Annual Meeting of the International Communication Association (41st, Chicago, IL, May 23-27, 1991).
PUB TYPE Speeches/Conference Papers (150) -- Information Analyses (070)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Communication Research; Higher Education; *Research Methodology; *Research Problems; *Time
IDENTIFIERS Literature; *Message Processing

ABSTRACT

Message processing literature could conceptualize process in one of two distinct ways: a single over-time process as described by J. N. Cappella, versus several processes as described by D. K. Berlo. An examination of literature finds that theories are based on both forms of these over-time processes. However, operationalization rarely measures either type of process over time. That is, process approaches are more common in theory than in measurement. A breakdown of the dimensions of time appropriate to over-time research yields five specific dimensions: (1) the time-frame of the study; (2) the time-lag over which effects are measured; (3) the duration of the independent variable; (4) the duration of the dependent variable; and (5) the effect span. In order to improve scholarly research attempts at exploring over-time processes, the two distinct theories of process should be carefully considered, and these time-based dimensions should be carefully used. (Three figures and four tables of data are included; 193 references and four appendixes are attached.) (Author/SR)

Time and process in message processing literature

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Paper presented to
the Information Systems Division
International Communication Association,
Chicago, IL,
May 27, 1991.

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Abstract

Message processing literature could conceptualize process in one of two distinct ways, a single over-time process as described by Cappella, versus several processes as described by Berlo. An examination of literature finds that theories are based on both forms of these over time processes. However, operationalization rarely measures either type of process over time. That is, process approaches are more common in theory than in measurement. A breakdown of the dimensions of time appropriate to over-time research yields five specific dimensions: (1) the time-frame of the study, (2) the time-lag over which effects are measured, (3) the duration of the independent variable, (4) the duration of the dependent variable, and (5) the effect span. In order to improve our attempts at exploring over-time processes, two important aspects are suggested. First, we should carefully consider the two distinct theories of process; and second, we should make careful use of these time-based dimensions.

Time and process in message processing literature

Process is an important aspect of the study of communication (Cappella, 1977). In mass communication research, however, because of the apparent non-interactivity of mass media, process is often studied in its simplest instantiations. And because messages typically occur at a single point, time also appears not terribly important (Kline, 1977). Researchers, following paradigms established by Hovland, Osgood, and Lazarsfeld, and in anticipation of limitations in statistics, may reduce process to its simplest instantiation in research designs. Therefore, in mass communication research paradigms, we should pay special attention to time and process so they are not dismissed, ignored as unimportant, or allowed to slip away unnoticed in the background.

One area of mass communication research, message processing, is particularly able to involve more thorough analyses of processes that occur over time. Since message processing is primarily concerned with how people discern meaning from messages, processing can be seen as a psychological process that takes place over time. This area is a source of information about how time and process are, and have yet to be, incorporated into mass communication research. This study will examine how process and time have been conceptualized and operationalized in message processing research over the past ten years. Specifically, through an analysis of published research, this paper will examine how conceptualizations and operationalizations of process and time are used in research: in factors that influence message processing, in factors that are influenced by message processing, and in research designs that examine message processing. How conceptualizations of time affect research theory, examinations of process, and research findings will be also be discussed.

Process

The calls for studying communication phenomena over time (Schramm, 1971; Rogers, 1976; Kline, 1977) have resulted in more interest in process research. In some instances researchers ideas of "process" may be synonymous with Berlo's (1977) definitions of process as complex organization. In Berlo's definition "process" entails several processes that occur at simultaneously or at different times. Changes in X lead to changes in B, which lead to changes in C, which in turn lead to changes in Y. Feedback may occur from one stage to another. This multiple-stage approach can also be seen in Petty & Capioppo's (1979) differential routes to persuasion, Ray's hierarchy of effects (Batra & Ray, 1985) or Price & Roberts' (1987) public opinion processes. These approaches describe several steps -- yes/no decisions or levels of feedback -- which affect subsequent outcomes. This definition of process is often illustrated with boxes and arrows flowcharts. An example is presented in Figure 1.

However, Cappella challenges this definition because that it "entails viewing events as ever-changing, without beginnings, ends, or any fixed sequence of events, and with all factors affecting one another (1977: 43)." Instead, Cappella offers an alternative and suggests that process and communication phenomena simply be conceived as a "time-dependent processes" (1977: 45). The second definition, therefore, is Cappella's (1977) "time-dependent process," actually a single over-time process. Changes in the independent variable X lead to changes in the dependent variable Y. In this way, Cappella's definition of time is more in accord with Berlo's definition of process as (1977) "change over time" or as "activity." This single process is the one most often covered in methodological texts (c.f., Kelly & McGrath, 1988). The single-stage approach is often illustrated as linear trends, step, curvilinear or periodic functions that occur over time on a particular variable (Kelly & McGrath, 1988). A diagram of a single-stage process is presented in Figure 2.

What is called "process," therefore, reflects two fundamentally different definitions. And these two different definitions of process, in turn, lead to two different approaches to the measurement of process. According to the first definition, intervening variables need to be measured. To the extent that the variables are truly intervening and unobservable, process cannot be examined. For the second definition, process can best be ascertained by measuring all of the independent variables and interactions. Process can then be inferred via critical tests that offer conflicting predictions about the underlying process and its relationship to the variables (Cappella, 1977; Greene, 1988). This approach suggests that processes are "observed" in the same way that physicists observe acceleration, mass or temperature -- by measuring the input and output of the system (Woelfel & Fink, 19??).

Time

Of course, any analysis of process rests on studying change over time (Kelly & McGrath, 1988). Time, therefore, is a critical aspect of process. In an attempt at examining the different roles of time in agenda-setting research paradigms, Eyal, Winter & DeGeorge (1981) distinguish five temporal features. The generalized version of this typology which could be applied to communication and message processing research is (1) the time-frame of the study, (2) the time-lag over which effects are measured, (3) the duration of the independent variable, X, (4) the duration of the dependent variable, Y, and (5) the effect span. In communication literature, studies are conducted over varying lengths of time, the manipulation lasts anywhere from 30 seconds to a several hours, the time-lag between the manipulation of the independent variable and assessment of influence is arbitrary, the period over which audience effects are measured for varying lengths of time, and for arbitrary lengths into the future. These different categorizations of time in research are of interest not only because they provide insights into how process takes place, but also because they may affect the findings of this research (Monge, in press). How each of the individual time-based factors could influence potential effects will be discussed next.

Time frame of the study

One way to examine how measures of process are actually attempted in research is through investigation of how time is used in research. Specifically, the most important determinant of observational process measures is the time frame design of the study. The time frame is the entire length of the research endeavor (Eyal *et al.*, 1981). It includes baseline data, the period during which the independent variable is manipulated, the effects take place, and the time period that the dependent variable is measured. The length of time over which a study was conducted could influence the obtained results in several ways. First, the time-frame of the study constrains how the researchers can examine the underlying processes. Second, the time-frame may affect the power of the analysis. Third, the time-frame may affect the practical meaning of the experiment. And fourth, the time-frame may affect the external validity of the experiment.

Time-Lag of Effects

It is generally believed that the effects of communication take time to occur (Kelly & McGrath, 1988). This lag is the period between the end of the manipulation of the independent variable X and the start of the measurement of the dependent variable Y (Eyal *et al*, 1981; Monge, in press). In research, however, the dependent variable is usually assessed immediately or after an arbitrary time lag from exposure (Kelly & McGrath, 1988). A failure to allow a sufficient length of time, or too great a time for temporary changes reduces the chances of finding effects, especially legitimate ones (Monge, in press).

Duration of the Independent Variable

The independent variable, X, may be manipulated for varying lengths of time. Using too short a manipulation may have three potential effects. First, it also may reduce the power of the manipulation and the chance of finding effects. Second, the time-frame may affect the practical meaning of the experiment. For example, a message processing study which attempted to teach strategies in a 2-minute instruction period might be drastically different than one which used weekly 30-minute sessions over the course of several weeks. And third, the practical meaning of the experiment, may, in turn, affect the external validity of the experiment.

Duration of the Dependent Variable

The dependent variable, Y, may have a duration lasting from brief to perpetuity. For example, a message may be quickly dismissed, or it may provide a lasting basis for counterarguing (e.g., Pfau & Burgoon, 1988). However, failure to allow a sufficient period for observation decreases the power (or, alternatively, increases the noise) and also reduces the chance to find legitimate effects. Relatedly, too short a time-lag may be compensated for by allowing a sufficient measurement period in order to actually measure that time lag.

Effect Span

Despite a literatures in psychology about forgetting and in communication about "sleeper effects," there are infrequent studies of the course of an effect ,Y, over time. Effect span not only constitutes the duration assessed for Y, but also the entire length of time for which there is an impact, measured or not. The effect span, therefore, can be thought of as the life-cycle of effects. Relatedly, effects can be described as permanent or temporary (Monge, in press).

Method

In order to examine how process and time are conceptualized and operationalized, this study examined published message processing literature in the field of communication. Specifically, it looked at literature published between 1980 and 1989 in Communication Research, Human Communication Research, and several message processing books. Because message-processing is a recent foray in communication research, and these sources cover processing much more than Journalism Quarterly or the Journal of Communication, this sample should give a reasonable insight into the variety of over-time research that has occurred in message processing research over this period.

Because of the reported dearth of process studies (Kline, 1977; Monge, in press), further analysis of process rests on examination of the various uses of time. And although these factors vary from study to study, they are rarely examined systematically. By organizing these conceptualizations into Eyal *et al.*'s (1981) categorization scheme, we can gain insights into the various roles that time plays in message processing. Specifically, we are interested in the ways in which time (and process) are conceptualized and operationalized in the literature.

For this study, the unit of analysis was a single piece of research -- journal article, chapter, or complete book. Research was categorized as either data-based or solely theoretical. According to this sampling, the investigation identified a total of 126 articles. How time was used in the conceptualization of process (single- versus multiple-step process) and its operationalization (1-point, 2-point, panel, path, or time-series designs) was examined. The study also examined the use of time according to the time-frame of the study, the time-lag of effects, duration-based independent and dependent variables, and the effect span .

Results

Process

Conceptualizations of process over time

Both single- and multiple-stage approaches to process were observed in the message processing literature. (Define each). The rate of these two approaches is shown in Table 1 (raw data in Appendix A).

TABLE 1:
Conceptualizations of process by year

Definition	80-81	82-83	84-85	86-87	88-89	Total
Single step:	13	14	13	22	19	81
Multiple steps:	1	9	10	13	6	38
% Multiple	17%	36%	43%	37%	24%	32%

Table 1 shows that processes were conceptualized in both single-step and multiple-step forms. The simpler single-stage approach accounts for about two-thirds of the theoretical approaches. At the conceptual level, therefore, theory appears to be based on two types of over-time process models, single process and multiple-stage processes.

Time

Time-Frame of the Study

The time frame of the study was examined. Although almost all of the studies mentioned the year, month or season in which the research was conducted, such information is really of limited utility in understanding research. Although it may be useful in some later meta-analysis of surveys, it really has limited utility in understanding experimental research. An example of a more useful mention of the time frame included the distance between X and Y measurements, for example, "over 3 successive evenings one week apart" (Fitzpatrick & Dindia, 1986).

Because of this limited information on time-frames, we were forced to focus on the design of the study. Table 2 presents a breakdown of how process was most frequently operationalized across these studies (The raw data are in Appendix B). Of the studies sampled, 61% were 1-point designs, 10% were 2-point, 10% were panel, 6% were path, and 13% were time-series designs. This sample of the literature demonstrates that process is most frequently operationalized and studied at a single point in time; that is, as a correlational relationship. Over-time designs made up only 39% of the research in message processing over the past 10 years. And in only a minority of the studies (e.g., Batra & Ray, 1985; Chaffee & Roser, 1986; Watt, 1979) did researchers attempt to examine multiple stages of process within a single study.

TABLE 2:
Operationalizations of process by year

Time Points	80-81	82-83	84-85	86-87	88-89	Total
1-Point:	17	12	13	18	17	77
2-Points:	0	3	3	3	3	12
Panel:	1	0	3	5	4	13
Path or LISREL	0	1	2	2	2	7
Time-Series:	3	1	1	7	5	17
TOTAL	21	17	22	35	31	126

The previous section on conceptualizations demonstrated that process is conceptualized as both single- and multiple-stage processes that occur over time. That is, all of these studies *conceptualize* communication as an over-time process (either single- or multiple-stage). But now compare how these processes are actually conducted. As can be seen in Table 2, process is usually *operationalized* via static measures. There is a large

discrepancy, therefore, between the way processes are conceptualized versus how they are operationalized.

Time-Lag of Effects

Since communication effects take time to occur (Eyal *et al.*, 1981; Kelly & McGrath, 1988), the lag is the period between the end of the manipulation of the independent variable X and the start of the measurement of the dependent variable Y is very important. In this analysis, however, only a few studies mention the time lag between manipulation and measurement. And even fewer (7) manipulate this time-lag: for example, Fitzpatrick & Dindia (1986) measured television's effect on communication immediately after, a week after, and two weeks after exposure, and Pratkanis & Greenwald (1986) measured effects after different delays from exposure (Lichtenstein & Srull, 1986; Pfau & Burgoon, 1988; Honeycutt, Cantrill & Greene, 1989; Kurke, Weick & Rawlin, 1989; Meadowcroft & Reeves, 1989; Pavitt, 1989)

Duration of the Independent Variable

The duration of the independent variable, X, is another time factor which may influence results. Across these 126 articles, time was important in independent variables on 86 occasions. The frequency of time-based conceptualizations are listed in Table 3 (the raw data are listed in Appendix C).

TABLE 3:
The use of Time-based Independent Variables by Year

Independent variables	80-81	82-83	84-85	86-87	88-89	Total
Time with medium:	11	4	5	11	5	36
Developmental level						
Age:	1	4	5	4	6	20
Grade level:	4	6	1	3	3	17
Lag (delay):	0	0	0	2	5	7
Complexity (rate):	0	1	1	4	0	6
Time (year)	0	1	0	4	0	5

One of the most frequent uses of time in these conceptualizations as an independent variable was, as Kline (1977) noticed, "the amount of time spent (with a particular medium...)" (p. 184). Researchers have responded to criticisms of this measure[1], so that "time spent" now usually refers to specific content. But with this change, "time spent" was the most used individual conceptualization of time in duration-based independent measures with 36 occurrences. In message processing literature, time spent is usually correlated with a dependent measure: for example, equating X amount of television with knowledge, attitude, or behavior level Y. This was usually done by measuring X as self-report for a specified period of time (e.g., Shoemaker, Schooler, & Danielson, 1989).

Another frequently used conceptualization of time in an independent variable was as a measure of cognitive development. These occurrences operationalized time as: children's age (20) and grade (17). The use of children's age or grade as measures of cognitive level is the incorporation of Piagetian concepts of development into cognitive information-processing communication models. As originally derived, Piaget's theories involved a longitudinal study of individual children. However, by assuming that cohort effects are negligible relative to developmental differences, and by assuming that the developmental patterns across children are similar, researchers compare across children of different ages to approximate the developmental process of an individual child. That is, researchers are not really examining how the effects occur for a particular child over time (a range of X), but approximating these conditions (by sampling X) across different children.

The third most frequent use of time in independent variables was as a measure of complexity (e.g., Rotschild, Thorson, Reeves, Hirsch & Goldstein, 1986; Reeves, Thorson & Schleuder, 1986). And one unusual but interesting operationalization was time in menstrual cycle as a measure of mood (Meadowcroft & Zillmann, 1987). In this case,

[1] First, accuracy of memory and aggregation covering periods as long as a year may be very difficult; second, content is not homogeneous; and third, social desirability may affect answers.

as in children's ages, the same woman was not measured over time, but women were sampled across a range of Xs.

Another use of a duration-based measure of time was the length of the stimulus itself (e.g., Drew & Reeves, 1980; Pingree, 1986; Rimmer, 1986). However, since each piece of research usually stuck to a particular stimulus length, and this length didn't vary within studies, stimulus length did not appear as a traditional independent variable. For example, an experiment may have used a single 30-second campaign commercial. Another study may have used a 1 hour debate. Of course, meta-analyses may wish to consider whether the different lengths led to different conclusions.

Probably because of the propensities to compare exposure with effects, to examine the cognitive effects of television on children and to measure the complexity and length of stimulus materials, message processing researchers were fairly likely (86/126) to mention the duration of at least one independent variable in an article.

Duration of the Dependent Variable

The dependent variable's, Y's, duration is an important time-based factor. However, with only 38 occurrences in 126 articles, the duration of the dependent variable was not frequently assessed. The data are presented in Table 4 (raw data in Appendix D).

TABLE 4:
The use of Time-based Dependent Variables by Year

Intervening variables	80-81	82-83	84-85	86-87	88-89	Total
Time with medium:	2	1	3	3	0	9
Dependent variables	**80-81**	**82-83**	**84-85**	**86-87**	**88-89**	**Total**
Time with medium:	61	3	3	5	3	20
Processing difficulty:	0	0	0	1	6	7
Eye gaze time (rate):	2	1	0	2	2	7
Fluency:	0	0	0	0	4	4

The most frequent of these time-based dependent variables was time spent with media (or a particular medium). Time spent made 20 occurrences as a dependent variable, and 9 as an intervening variable. This was often a self-report, but it was also measured by the interviews (e.g., Heeter, 1985; Pingree, 198), diaries (e.g., Hawkins, Pingree & Adler, 1987; Robertson, Ward, Gatignon, & Klees, 1989), or observation periods (e.g., Fitzpatrick & Dindia, 1986; Rotschild *et al.*, 1986; Berger & Kellerman, 1989).

Two other uses of duration-based dependent variables, with 7 occurrences each, was as a measure of eye contact or as a measure of cognitive load or processing difficulty. (Lichtenstein & Srull, 1986; Pfau & Burgoon, 1988; Honeycutt, Cantrill & Greene, 1989; Kurke, Weick & Rawlin, 1989; Meadowcroft & Reeves, 1989; Pavitt, 1989). Cognitive reaction time has shown a notable growth in recent years, with five of these occurrences in the last two years. The importance of processing time as a variable in communication research is through limited processing capacity models used in psychology (Bobrow & Norman, 1972; Neisser, 1976). In addition, four "fluency" calculations were also based on time (e.g., Berger, Karol & Jordan, 1989; Greene & Lindsey, 1989). An interesting operationalization of a dependent variable over time was viewers' talking time during a program as a measure of interest (Fitzpatrick & Dindia, 1986).

Effect Span

Despite a literatures in psychology about forgetting and in communication about "sleeper effects," there is little evidence of studying the course of time over which an effect Y occurs. Effect span not only constitutes the duration assessed for Y, but also the entire length of time for which there is an impact. The effect span, therefore, can be thought of as the life-cycle of effects.

In this investigation, only 6 studies mentioned effect-span. In five of these cases, this was a comparison between immediate versus delayed assessments of a message's effect. In these cases, the effect-span was mentioned because it was a substantive part of

the research (e.g., Pratkanis and Greenwald, 1986; Meadowcroft & Reeves, 1989). One study also examined the span of effects as a consequence of the time-lag of measurement, that is, comparing both the amount and nature of those effects (Fitzpatrick & Dindia, 1986).

Discussion

Conceptualizations of time and process

The two distinct conceptualization of process that were found in theoretical writings about process: process as a single step, and process as a series of steps, were also found in message processing literature. The single-step approach was more common, especially in data-based literature. There are probably several reasons for the lesser likelihood of multiple-stage measurements of process in actual research. First, some of these multiple-stage processes are from chapters which appear to be intended to provide a meta-theoretical approach to processual research. Second, this multiple-step processual analysis is derived from or is suggestive of a program of research. Third, the statistics for this line of research, such as path analysis or LISREL are not well practiced. For example, LISREL may be the appropriate statistical technique for multiple-stage analysis but may be overlooked in an attempt to use an "easier" or a more common assessment technique.

Which definition of process is being used has serious implications. Traditional theories and research designs offer ways of testing the single-step definition of process -- Xs effect on Y (Basil, 1990; Cappella, 1977). However, the other theories which call for a multiple-step approach -- how X alters intervening stages B and C which, in turn, affect Y must rely on newer and lesser-known statistical approaches. It is not clear how the use of an innapropriate conceptualization of the underlying process and thus an innapropriate statistical approach may affect research findings.

In addition to the discrepancy between the different forms of process, there also appears to be a general discrepancy between the ways processes are conceptualized versus how they are operationalized. There are probably two important reasons. First, single time-point research is easier to conduct -- cheaper and faster. Second, researchers may be anticipating statistical limitations. In some of these cases researchers are attempting to measure process through single time-point research, but by using over-time variables. This approach has been used frequently.

Of course, there are reasons that research that claims to measure process may be based on correlational data. This may reflect an attempt to gather over-time data in easier ways -- for example, several of these studies involve self-report questions that ask subjects to estimate their viewing over a certain period of time. So although the data are gathered at a single point in time, they are intended to reveal information about over-time independent or dependent variables. Further analysis of the actual use of over-time variables suggests that this was, in fact, attempted with duration-based independent and dependent variables.

In order to gain an understanding of over-time processes, it is also necessary to analyze the use of the various dimensions of time in research design. In such an analysis, all five of Eyal *et al.*'s (1981) uses of time appeared in message processing literature. However, they were generally used very infrequently. The first factor, time frame an inherent part of all studies, was explicitly mentioned only in a minority of studies. The second factor, the time-lag over which the effects were measured was usually mentioned only in studies where time-lag between manipulation of the independent variable and measurement of the dependent variable was an integral part of the design (e.g., Lichtensterin & Srull, 1986; Meadowcroft & Reeves, 1986; Rotschild *et al.*, 1986). Third, the duration of the independent variable was mentioned when the duration was an important part of the design. In general, however, duration-based independent variables were fairly common, being used on 86 occasions. Fourth, the duration of the dependent variable, was also only mentioned when the dependent variable, by definition, occurred over a period of

time. This was somewhatinfrequent with 38 occurances. Finally, the effect span was mentioned only on a few occasions, when it was an integral part of the design. So most of Eyal *et al.*'s other time factors were usually mentioned only when the use of time was an integral part of the variable or research design.

Other conceptualizations of time in communication research.

By comparison with message processing research, the area of interpersonal communication demonstrates a slightly different picture. Because context is so important to the study of discourse, especially the interactive discourse of interpersonal communication, studies look at stochastic or Markovian sequencing (Cappella, 1979), lag sequential analysis (Dindia, 1986), changes in eye gaze over time (Vanlear, 1987), and how to "cluster" events such as utterances (Hamilton & Hunter, 1985). Interpersonal research, therefore, relies more heavily on over-time dependent measures. Interpersonal researchers, however, use fewer over-time independent variables.

Uses-and-gratifications research is also more likely to use over-time dependent Y variables. Specifically, most studies use time with a medium as an intervening or dependent variable (Babrow, 1989; Finn & Gorr, 1988; Gallowoay & Meek, 1981; Miyazaki, 1981; Palmgreen, Wenner & Rayburn, 1980, 1981; Palmgreen & Rayburn, 1982; Rayburn & Palmgreen, 1984; Rubin, 1981; Rubin & Perse, 1987a, 1987b; Rubin, Perse & Powell, 1985; VanLeven, 1981). Largely, the increasing use of time spent as intervening and dependent variables is because uses and gratifications theory considers viewing time to be an outcome of viewer motivations (c.f., Finn & Gorr, 1988; Eyal, Winter, & DeGeorge, 1981; Jensen & Rosengren, 1990). And, like interpersonal researchers, uses and gratifications are also less likely to use over-time independent variables than message processing researchers.

Implications

The failure of message processing literature in particular, and communication literature in general, to explicitly mention each of these dimensions of time except as directly related to the research question is a potentially serious problem for the field. Because without a careful examination, effects of the time factors cannot be understood. For example, studies which fail to consider time-lag are making several assumptions. First, they assume that the effects are immediate or that sufficient time has passed between manipulation that the effects have occurred. Second, they assume that the form of the process is sufficiently linear so that treatment effects are positive and measurable. Third, they assume that there is no large underlying cyclicality. And fourth, they assume that the nature of the effects remain constant and permanent, and only the amount of effects vary. Without actually varying or examining time lag no investigation of these differences can be accomplished.

The failure to distinguish between these different time-based factors may also cause problems. For example, time lag may have different effects from effect span in information and persuasion levels. In such a case, suppose that information gain occurs almost immediately, persuasion more slowly. This may be because schematically-driven memory insures that motivated subjects have no appreciable decay for facts or attitudes. Less motivated subjects may also have poor memory for facts, but good retention of attitudes. When the "effects" are assessed could yield quite different results which could appear to be differences in information gain, attitude change, forgetting and "sleeper" effects. Regardless of when assessed, less motivated subjects would show lower knowledge levels than motivated subjects. However, the time of assessment would affect measured persuasion effects. Early measurement would show neither group having been persuaded; later assessment would show that motivated subjects were persuaded, but not non-motivated subject. Imagine the differences a correlational analysis between knowledge and persuasion would show. Early measurement would show no relationship; later

measurement would show a positive relationship. In this scenario the research failed to clarify the distinction between the time-lag between manipulation and measurement, versus the span of effects. So for a little more effort, this research could have provided information on the hierarchy of effects over time versus their decay.

Data-based message processing research generally fails to make use of exploratory or descriptive examinations of multiple-stage processes. These forms of analysis could provide an interesting link to critical theory or as a useful entree into theory-based time-series research. Careful use of Eyal *et al.*'s five temporal features should yield more precise examinations and evaluations of communication effects. As Monge has noted, "vague and inexact specifications of process characteristics are preferable to no specifications at all" (in press: 9). Researchers and journals in all areas of social science would benefit from taking the time, effort, and space to always consider these important temporal aspects of research design. By doing so, it would add to the comparability of the literature. Taking special note of these important dimensions of time and process in research designs would also yield a more thorough understanding of research. And it would suggest that researchers not constrained themselves to the briefest instantiations of research, but experiment with descriptive and exploratory examinations of process examining large, multiple-stage theories of process.

The calls for process research, therefore, have shown some effects. For example, since Kline (1977:198) noted that, "continued calls for process models of mass and interpersonal communication alert us to inadequacies in our traditional research designs," we have seen an increase in theories describing over-time processes. At this point, maybe we should no longer be concerned with shortcomings in theories, but more with shortcomings in research methods and attention to time-based factors.

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APPENDIX A:
Studies by conceptual process measure (by source and year)

Single:

CR (52): Drew & Reeves, 1980; Hawkins & Pingree, 1980; Hirsch, 1980, 1981a, 1981b; Palmgreen *et al.*, 1980; Todd & Brody, 1980; Bybee, 1981; Gerbner *et al.*, 1981a, 1981b; Reese & Miller, 1981; Rubin, 1981; Zimmer, 1981; Brunk & Fiskin, 1982; Christenson, 1982; Collins & Wellman, 1982; Rubin & Rubin, 1982b; Sillars & Parry, 1982; Shoemaker, 1982; Lemert *et al.*, 1983; McLeod *et al.*, 1983; Durkin, 1984; Pingree, 1984; Blosser & Roberts, 1985; Fallis, Fitzpatrick & Friestad, 1985; McLeod & McDonald, 1985; O'Keefe, 1985; Thorson, Reeves & Schleuder, 1985; Culbertson & Stempel, 1986; Dennis, 1986; Fitzpatrick & Dindia, 1986; Heikken & Reese, 1986; Meadowcroft, 1986; Rimmer, 1986; Rotschild *et al.*, 1986; Drew & Grimes, 1987; Elliot & Rosenberg, 1987; Gandy *et al.*, 1987; O'Keefe & Reid-Nash, 1987; Babrow *et al.*, 1988; Hoffner, Cantor & Thorson, 1988; Kunkel, 1988; Pettey, 1988; Reep & Dambrot, 1988; Watkins, 1988; Berger & Kellerman, 1989; Demers *et al.*, 1989; Finnegan *et al.*, 1989; Livingstone, 1989; Meadowcroft & Reeves, 1989; Perloff, 1989; Shoemaker *et al.*, 1989.

HCR (22): Reeves & Garramone, 1982, 1983; Rubin & Rubin, 1982a; Acker, 1983; Bryant *et al*, 1983; Cohen *et al*, 1983; Runco & Pezdek, 1984; Desmond *et al*, 1985; Rubin *et al*, 1985; Chaffee & Schleuder, 1986; Kellerman, 1986; Hawkins *et al*, 1987; Potter, 1987; Rubin & Perse, 1987b; Stafford *et al*, 1987; Wilson, 1987;

Books (7): Alwitt, 1985; Anderson, 1985; Pratkanis & Greenwwald, 1985; Ball, Palmer & Millward, 1986; Gerbner *et al.*, 1986; McCombs & Gilbert, 1986; Iyengar & Kinder, 1987.

Multiple:

CR (19): Galloway & Meek, 1981; Chaffee & Miyo, 1983; Garramone, 1983, 1984; Levy & Windahl, 1984; Roberts *et al.*, 1984; Kellerman, 1985*; Allen & Hatchett, 1986; Chaffee & Roser, 1986; Tims, 1986; Choi & Becker, 1987; Fulk *et al.*, 1987*; Meadowcroft & Zillman, 1987; Stamm, 1987; Dindia, 1988; Hoijer, 1989; O'Keefe & Shepard, 1989; Pavitt, 1989; Robertson *et al.*, 1989.

HCR (6): McLaughlin & Cody, 1982; Reardon, 1982; Welch & Watt, 1982; Dindia, 1986; VanLear, 1987; Pfau & Burgoon, 1988;

Books (13): Batra & Ray, 1983*; Graber, 1984; Burnkrant & Sawyer, 1985*; Mitchell, 1983*; Rossiter & Percy, 1983*; Alwitt & Mitchell, 1985; Beattie & Mitchell, 1985; Cacioppo & Petty, 1985; Greenwald & Leavitt, 1985; Lutz, 1986*; Tan, 1986*; Winett, 1986; Zillmann & Bryant, 1986*.

* Theory-only (no data) piece

APPENDIX B:
Studies by operational process measure
(by source and year)

1-Point: Correlational, Regression & ANOVA

CR (53): Drew & Reeves, 1980; Hawkins & Pingree, 1980; Hirsch, 1980, 1981a, 1981b; Palmgreen, *et al.*, 1980, 1981; Bybe, 1981; Gerbner *et al.*, 1981a, 1981b; Miller, 1981; Reese & Miller, 1981; Rubin, 1981; Zimmer, 1981; Christenson, 1982; Collins & Wellman, 1982; Miller & Reese, 1982; Payne & Caron, 1982; Shoemaker, 1982; Sillars & Parry, 1982; Garramone, 1983, 1984; Durkin, 1984; Levy & Windahl, 1984; Pingree, 1984; Roberts *et al.*, 1984; Sharp, 1984; Blosser & Roberts, 1985; McLeod & McDonald, 1985; Allen & Hatchett, 1986; Cantor *et al*, 1986; Cobb, 1986; Culbertson & Stempel, 1986; Heikkinen & Reese, 1986; Meadowcroft, 1986; Pingree, 1986; Rotschild *et al.*, 1986; Tims, 1986; Drew & Grimes, 1987; Elliot & Rosenberg, 1987; Gandy *et al.*, 1987; Meadowcroft & Zillman, 1987; Babrow *et al.*, 1988; Finn & Gorr, 1988; Hoffner *et al.*, 1988; Kunkel, 1988; Reep & Dambrot, 1988; Pettey, 1988; Watkins, 1988; Hoijer, 1989; Meadowcroft & Reeves, 1989; Perloff, 1989; Shoemaker, *et al.*, 1989.

HCR (19): Alwitt, *et al.*, 1980; Hawkins & Pingree, 1981; Joclyn, 1981; Reeves & Garramone, 1982, 1983; Acker, 1983; Bryant *et al.*, 1983; Cohen *et al*, 1983; Runco & Pezdek, 1984; Desmond, *et al.*, 1985; Hawkins, *et al.*, 1987; Potter, 1987; Wilson, 1987; Abelman, 1989; Badzinski, 1989; Berger, *et al.*, 1989; Greene & Lindsey, 1989; Honeycutt *et al.*, 1989; Roloff & Janiszeski, 1989.

Books (5): Alwitt, 1985; Beattie & Mitchell, 1985; Cushing and Douglas-Tate, 1985; Pratkanis & Greenwald, 1986; Winett, 1986.

2-Point:

CR (8): Chaffee & Miyo, 1983; Lemmert *et al.*, 1983; Fallis, *et a;*, 1985; O'Keefe, 1985; O'Keefe & Reid-Nash, 1987; Kurke *et al.*, 1989; Babrow, 1989; Pavitt, 1989

HCR (2): Welch & Watt, 1982; Stafford, *et al*, 1987.

Books (2): Lichtenstein & Srull, 1985; Iyengar & Kinder, 1987.

Panel or Repeated Measures

CR (8): Todd & Brody, 1980; Thorson, Reeves & Shleuder, 1985; Whitney & Goldman, 1985; Dennis, 1986; Fitzpatrick & Dindia, 1986; Stamm, 1987; Demers *et al.*, 1989; Finnegan *et al.*, 1989

HCR (3): Chaffee & Schleuder, 1986; Pfau & Burgoon, 1988.

Books (2): Graber, 1984; Petty & Cacioppo, 1986.

Path or LISREL:

CR (5): Tims & Masland, 1985; Chaffee & Roser, 1986; Choi & Becker, 1987; Perse & Rubin, 1989; Robertson *et al.*, 1989.

HCR (1): Reardon, 1982.

Books (1): Batra & Ray, 1985.

Longitudinal: Rates, Regression, Markovian, Lag-Sequential

CR (12): Arundale, 1980*; Frazaer, 1981; Korzenny & Baur, 1981; Brunk & Fiskin, 1982; Rotschild *et al.*, 1986; Rimmer, 1986; Fulk *et al.*, 1987*; Dindia, 1988; Berger & Kellerman, 1989; O'Keefe & Shepard, 1989; Pavitt, 1989; Robertson *et al.*, 1989

HCR (4): McLaughlin & Cody, 1982; Dindia, 1986; Kellerman, 1986; VanLear, 1987.

Books (2): Anderson, 1985; Iyengar & Kinder, 1987.

* Theory-only (no data) piece

APPENDIX C:
Studies using specific independent variables (by source and year)

Independent variables

Time with a medium:

CR: (25): Hawkins & Pingree, 1980; Hirsch, 1980, 1981a; Gerbner *et al.*, 1981a, 1981b; Reese & Miller, 1981; Zimmer, 1981; Miller & Reese, 1982; Payne & Caron, 1982; Brunk & Fishkin, 1982; Sharp, 1984; Fallis, *et al.*, 1985; McLeod & McDonald, 1985; Whitney & Goldman, 1985; Culbertson & Stempel, 1986; Dennis, 1986; Heikken & Reese, 1986; Choi & Becker, 1987; Elliot & Rosenberg, 1987; Gandy *et al.*, 1987; Reid-Nash, 1987; Watkins, 1988; Pentney, 1988; Babrow, O'Keefe, Swanson, Meyers & Murphy, 1988; Schoemaker, Schooler & Danielson, 1989.
HCR (11): Roloff & Greenberg, 1980; Williams, 1980; Hawkins & Pingree, 1981; Joslyn, 1981; Messaris & Sarett, 1981; Reeves & Garramone, 1982; Desmond *et al.*, 1985; Chaffee & Schleuder, 1986; Hawkins *et al.*, 1987; Potter, 1987; Abelman, 1989.
Books (1): Winett, 1986.

Age (in years)

CR (10): Durkin, 1984; Pingree, 1984; Blosser & Roberts, 1985; O'Keefe, 1985; Dennis, 1986; Pingree, 1986; Babrow, *et al.*, 1988; Kunkel, 1988; Hoffner, Cantor & Thorson, 1988; Robertson, *et al.*, 1989.
HCR (9): Alwitt, *et al.*, 1980; Reardon, 1982; Reeves & Garramone, 1983; Bryant, *et al.*, 1983; Williams, 1983; Heeter, 1985; Hawkins *et al.*, 1987; Abelman, 1989; Badzinski, 1989.
Books (1): Anderson, 1986.

Children's grade (in school):

CR (7): Drew & Reeves, 1980; Hawkins & Pingree, 1980; Hirsch, 1980; Christenson, 1982; Collins & Wellman, 1982; Meadowcroft, 1986, Watkins, 1988.
HCR (10): Acker & Tiemens, 1981; Reeves & Garramone, 1982, 1983; Acker, 1983; Cohen, Adoni & Drori, 1983; Runco & Pezdek, 1984; Hawkins *et al*, 1987; Wilson, 1987; Abelman, 1989; Badzinski, 1989.

Complexity or redundancy:

CR (4): Thorson *et al.*, 1985; Rimmer, 1986; Rotschild et al., 1986; Drew & Grimes, 1987.
HCR (1): Welch & Watt, 1982.
Books (1): Cacioppo & Petty, 1986.

Lag time (delay):

CR (3): Kurke, Weick & Rawlin, 1989; Meadowcroft & Reeves, 1989; Pavitt, 1989.
HCR (3): Stafford *et al.*, 1987; Pfau & Burgoon, 1988; Honeycutt, Cantrill & Greene, 1989.
Books (1): Pratkanis & Greenwald, 1986.

Time (Year):

CR (2): McLeod *et al.*, 1983; Stamm, 1987.
HCR (2): Kellerman, 1986; VanLear, 1987.
Books (1): Iyengar & Kinder, 1987.

Time in menstrual cycle (mood):

CR (1): Meadowcroft & Zillmann, 1987.

APPENDIX D:
Studies using specific dependent variables (by source and year)

Intervening variables:

Time with medium:
CR (6): Chaffee & Miyo, 1983; Garramone, 1984; Roberts, *et al.*, 1984; Allen & Hatchett, 1986; Heikkinen & Reese, 1986; Tims, 1986.

Dependent variables (Discreet):

Processing difficulty: task time
CR: (2): Reeves & Thorson, 1986*; Pavitt, 1989
HCR (3): Greene & Lindsey, 1989; Honeycutt, Cantrill & Greene, 1989; Meadowcroft, 1989.

Processing difficulty: recognition or reaction time
HCR (2): Badzinski, 1989; Meadowcroft & Reeves, 1989.

Time with medium:
CR (4): Levy & Windahl, 1984; Meadowcroft, 1986; Fulk, Steinfield, Schmitz & Power, 1987; Robertson *et al.*, 1989.
Books (1): Zillmann & Bryant, 1986.

Talk time:
CR (4): Sillars & Parry, 1982; Fitzpatrick & Dindia, 1986; Berger & Kellerman, 1989; Pavitt, 1989.

Dependent variables, Rate:

Eye gaze time:
CR (5): Korzenny & Bauer, 1981; Sillars & Parry, 1982; Pingree, 1986; Meadowcroft & Reeves, 1989; Pavitt, 1989.
HCR (1): Alwitt *et al.*, 1980.
Books (1): Anderson, 1986.

Fluency: pause & false starts/minute:
CR (2): Berger & Kellerman, 1989; Pavitt, 1989.
HCR (2): Berger, *et al.*, 1989; Greene & Lindsey, 1989.

Perceived velocity
HCR (1): Acker, 1982.

* Theory-only (no data) piece

FIGURE 1:
Multiple-stage process

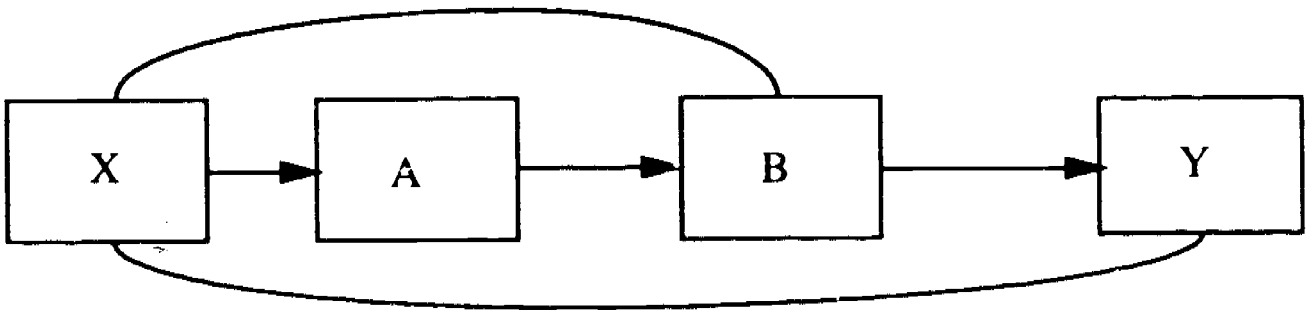

FIGURE 2:
Single stage process

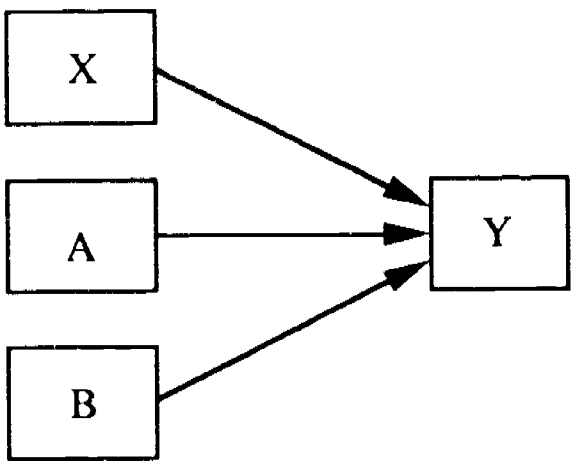

FIGURE 3:
Diagram of time factors