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ABSTRACT

To explore the idea of image complexity, i.e., the more complex the television news image, the more appeal it will have to audiences, two time series measures were obtained by showing a regular half hour broadcast of a "CBS Evening News" program to a group of viewers. The two measures were an objective, machine-based measure of the complexity of the television image across space (static complexity), and a subjective, semantic differential measure obtained at 15-second intervals throughout the newscast from 110 subjects in a response laboratory. The incorporation of time lags revealed two particular features: (1) there was significant evidence of cumulation, reaching back as far as 150 seconds, in the effect the static complexity had on subject responses; and (2) the form complexity variable, static complexity, when lagged back 150 seconds and tested against an authoregressive form of the subject responses, accounted for some 31% of the variance in those subject responses. Results also revealed that subjects showed significant variation in their responses to the newscast material up to 120 seconds in advance of associated changes in static complexity. The results may have implications for research in television news that confines itself only to content based variables at the expense of form variables, and that assumes only a cross-sectional relationship between newscast material and audience responses. (Author/HOD)

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# VISUAL COMPLEXITY IN TELEVISION NEWS: A TIME SERIES ANALYSIS OF AUDIENCE EVALUATIONS OF AN ELECTRONICALLY ESTIMATED FORM COMPLEXITY VARIABLE

by

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ABSTRACT

# VISUAL COMPLEXITY IN TELEVISION NEWS: A TIME SERIES ANALYSIS OF AUDIENCE EVALUATIONS OF AN ELECTRONICALLY ESTIMATED FORM COMPLEXITY VARIABLE

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The object of this study was to develop a content-free, form complexity measure of a network TV newscast based on pixel light intensity, and to test audience reactions over time to this measure. The form complexity variable, referred to here as static complexity, was measured throughout the newscast. It constituted the independent variable. The dependent variable, responses from 110 subjects throughout the same newscast, was measured with bi-polar, adjectival scales.

Three hypotheses were tested using regression techniques. The first hypothesis proposed that subject ratings of TV news would show a curvilinear relationship with the static complexity of the newscast image. This hypothesis, tested in cross-sectional form only, was not supported.

The second hypothesis proposed that static complexity had a cumulative effect on subject responses, such that a lagged form offered a better description of the relationship between the two variables than did the cross-sectional form. A simple, cross-sectional model, accounted for just six percent of the variance in subject responses. An autoregressive model, lagged back 150 seconds, improved the variance accounted for in the subject responses to 31 percent.

The third hypothesis proposed that subjects would be able to anticipate variations in the form complexity variable through the time series. Subjects showed significant variation in their responses to the newscast material up to 120 seconds <u>in advance</u> of associated changes in static complexity.

It was concluded that the results of this study may have implications for research in TV news which confines itself only to content-based variables at the expense of form variables, and which assumes only a cross-sectional relationship between newscast material and audience responses. It is suggested that both form variables and longitudinal relationships should be considered in the study of audience reactions to TV news.

## Introduction:

Conventional wisdom in television news production suggests that "talking heads" on television are boring. What viewers are said to want is action pictures. This production convention, apparently derived from the movie industry, has become part of the folklore of television news.

This study operationalizes "action footage" as a physical measure of image complexity and considers the idea that this image complexity is an important component of the appeal of television news. This appeal, it is suggested, is grounded in a basic drive humans have to process stimuli, the kind of stimuli television news provides. Taking the idea a stage further, the more complex the stimuli (i.e., the more complex the TV news image), the more appeal it will have to audiences. *Ipso facto*, action pictures are desired, "talking heads" are not. The former has a complex image, the latter is not complex enough.

In order to explore this image complexity idea, two time series measures were obtained using a regular half hour broadcast of a "CBS Evening News" program and a group of viewers. The two measures were:

1. An objective, machine-based measure of the complexity of the television image across space. This measure involved computer-based readings, at five-second intervals, of the variations in light intensity of the pixels which make up the image on the television screen. The measure is referred to in this

study as "static complexity."

2. A subjective, semantic differential measure obtained at 15-second intervals throughout the newscast from 110 subjects in a response laboratory. Subject responses to the newscast material were made in terms of ratings on a series of bipolar, adjectival scales.

The data obtained were analyzed using descriptive and time series regression techniques. There were two objectives in the study. The first was to identify and describe some of the processes involved in the viewing through time of a TV newscast. The second objective was to test three hypotheses drawn from an information processing perspective.

## A Review of Research: Content Analysis And the Audience of TV News.

The research reviewed here, it is suggested, demonstrates two general problems:

1. That the study of TV news has tended to neglect the video component of the material in favor of content aspects contained principally in the audio component.

2. That data based on post-viewing interviews are an unreliable, and perhaps even invalid, indicator of audience effects, insofar as they rely on self-reported data. Further, they deny access to the process of viewing, to information about phenomena which might occur within the newscast.

### Whither Video?

What are the meanings associated with the visual image? More importantly, what are the meanings associated with the audio-visual image, or with a sequence of audio-visual images?

For some researchers the solution has been to conclude that the visual image does not make much of a contribution to the message in comparison with the audio. The visual, so the argument goes, can then reasonably be ignored. This approach is perhaps a convenient one, because if the audio channel is the only one of interest, it can be transcribed on paper and then treated as if it were a content analysis of print.

After coding the audio-only from television news, and then comparing it with a coding of both audio and video, Pride and Wamsley found no difference between the two and concluded that transcripts can be used as data bases in studies of television news.(1) Katz, Adoni, and Parness found that recall of television news is only slightly improved by seeing it rather than hearing it.(2) In fact they even speculated that the video may be a distraction from comprehension.(3) They were not, however, able to find any evidence for this distraction effect. Edwardson, Grooms and Proudlove were also not able to find such a distraction effect.(4)

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(1) Richard A. Pride and Gary L. Wamsley, "Symbol Analysis of Network Coverage of Laos Incursion," Journalism Quarterly 49 (Winter 1972): 635-640.

(2) Elihu Katz, Hanna Adoni and Pnina Parness, "Remembering the News: What the Picture Adds to Recall," Journalism Quarterly 54 (Summer 1977): 231-239.

(3) Ibid., p. 232. Note, though, a review of the research on recall and comprehension by Colin Berry, "Learning from Television News: A Critique of the Research," Journal of Broadcasting 27 (Fall 1983): 359-370.

(4) Mickie Edwardson, Donald Grooms, and Susanne Proudlove,

It could be argued that the problem with much of this type of research is that the measurement systems used are of questionable validity. They do not seem to be measuring what they purport to measure.

Messages do not necessarally have a single meaning. Nimmo has suggested that the addition of the visual to a message increases its ambiguity.(5) Burns and Beier have found that the video channel evokes different kinds of responses in audiences than does the audio channel.(6) Padderud found that audio attributes of a television drama presentation loaded more on an evaluative dimension of meaning, while visual attributes loaded (to a lesser extent) on activity and potency dimensions.(7) Penn,(8) and Mandell and Shaw,(9) also found video attributes loading more on activity and potency dimensions of meaning than on evaluative dimensions.

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"Television News Information Gain From Interesting Video vs. Talking Heads," Journal of Broadcasting 25 (Winter 1981): 15-24.

(5) Dan Nimmo, The Political Persuaders (Englewood Cliffs, N.J: Prentice-Hall, 1970), p. 181.

(6) Kenton L. Burns and Ernst G. Beier, "Significance of Vocal and Visual Channels in the Decoding of Emotional Meaning," Journal of Communication, 23 (March 1973): 118-130.

(7) Allan Bruce Padderud, "A Process Analysis of the Relationship Between Form Complexity and Viewer Perceptions of a Televised Message," unpublished Ph.D. dissertation, The Ohio State University, 1976. Padderud's dimension labels, like those of the present study, are drawn from Charles E. Osgood, George J. Suci and Percy H. Tannenbaum, The Measurement of Meaning (Urbana, Illinois: University of Illinois Press, 1957).

(8) R. Penn, "Effects of Motion and Cutting Rate in Motion Pictures," AV Communication Review 19 (1971): 29-50.

(9) Lee M. Mandell and Donald L. Shaw, "Judging People in the News--Unconsciously," Journal of Broadcasting 17 (1973): 353-362.

This apparent "ambiguity of meaning" may be explained in what Pryluck and Snow call their psycholinguistic approach to the analysis of film.(10) Instead of just two channels, an audio and a video, they have distinguished six channels, all of which are presumed to interact with each other resulting in new kinds of information. Yet measurement systems which are typically used do not seem to take these channel differences into account. For example, the category system for measuring the visual component is often a limited and narrow one and may not reflect the many dimensions of analysis that a viewer might bring to the television screen. Further, the theoretical literature suggests that recall of TV news information as a dependent measure is often inadequate to the task.(11) The questions asked may use answers contained in the audio channel and not through video cues. Severin,(12) and Hsia,(13) have argued that the cues being considered must be available in the channel being tested. Recall tests may be further biased towards verbal messages insofar as they tend to employ cognitively based measures.(14) Visual media can present phenomena

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(10) C. Pryluck and R.E. Snow, "Toward a Psycholinguistics of Cinema," AV Communication Review 15 (1967): 54-75.

(11) Colin Berry, "Learning from Television News: A Critique of the Research."

(12) Werner J. Severin, "Pictures as Relevant Cues in Multi-Channel Communication," Journalism Quarterly 44 (Spring 1967): 17-22+, p. 20.

(13) H.J. Hsia, "Redundancy: Is it the Lost Key to Better Communication?" AV Communication Review 25 (Spring 1977): 63-85, p. 68.

(14) Thomas A. McCain and Sylvia White, "Channel Effects and Non-Verbal Properties of Media Messages: A State of the Art Review,"

which might be better assessed by affective, rather than cognitive, measures. Burns and Beier, for example, have pointed out that visual cues are dominant in affecting audience responses during audio/visual presentations, and that the conveyance of emotional meaning is more dependent on visual cues.(15) Finally, the testing of immediate recall may not evoke the same responses as longer-term testing. Hsia, for example, suggests that short-term memory encodes only the auditory characteristics of stimuli, whether those stimuli are auditory or visual.(16) Audio cues, then, may only be evoked when immediate (i.e., short term memory) recall is tested for, as is the case in many post-newscast viewing and recall studies.

Data Collection During or After Viewing?

In comparing subject reports of TV viewing with observation (by remote cameras) of that viewing, Bechtel et al found that there was a tendency for subjects to over-report.(17) For about half the time that subjects reported they were viewing television,

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paper presented at the Speech Communication Association Convention, New York, November, 1980, p. 11.

(15) Burns and Beier, "Vocal and Visual Channels in the Decoding of Emotional Meaning." p. 127.

(16) Hsia, "Redundancy: Is it the Lost Key to Better Communication?" p. 69.

(17) Robert B. Bechtel, Clark Achenpol, and Roger Akers, "Correlates Between Observed Behavior and Questionnaire Responses on Television Viewing," in Television and Social Behavior Vol. 4, Television in Day-to-Day Life: Patterns of Use, A Technical Report to the Surgeon General's Scientific Advisory Committee on Television and Social Behavior (Washington, DC: Government Printing Office, 1972), pp. 74-344. See also Mark R. Levy, "The Audience Experience With Television News," Journalism Monographs (April 1978), No. 55: 11.

they were observed to be not viewing. They were involved instead in other activities. News, for example, was found to be attended to just 55 percent of the time. Bechtel et al concluded that TV viewing should not be regarded as a behavior in its own right, but rather as part of a complex mixture of behaviors that apparently even the viewer is not completely aware of.

Subject self-reporting can be misleading. However, this is not meant to suggest that the TV screen must be attended to if messages are to have any effect on the audience. Given that TV viewing is part of a complex web of behaviors, is it not plausible that viewers might be selectively monitoring TV while engaging in other behaviors? What, then, are the particular program qualities which promote a release of viewer interest from TV news, and what are the program qualities which bring a viewer's interest back to the screen? Further, could there be an anticipation effect in operation, wherein the expectation that future program material may be more interesting than present material will act to disengage viewing of present material in anticipation of a re-engagement at some future, more interesting, point in the program?(18) This idea is addressed in the present study's second and third hypotheses. This apparent process of TV news "viewing" would appear, then, to be a complex of stimuli and behaviors which post-viewing surveys cannot possibly account for.

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(18) See, for example, Robert Krull, and William Husson, "Children's Anticipatory Attention to the TV Screen," Journal of Broadcasting 24 (Winter 1980): 35-47.

Time and the Process of TV Viewing:

The televising of even a half hour newscast offers an opportunity to consider the idea of process in the viewing of TV news. A review of the mass communication research literature suggests that the use of time as a variable in the manner proposed here is not common.(19) Time seems to be tgreated more often as a scarce resource, as in decisions regarding the budgeting of time for mass communication activity.

Krull et al have shown the utility of studying the process of TV viewing in their demonstration of the existence of cycles in set complexity in TV programming, and the way children's attention is related to this cycling.(20) Implied is an interaction between the viewer and the programming material. This interaction is central to the idea of process as it is used in the present study.

Information Processing and Television:

We are information-seeking beings. More fundamentally, we are stimulus seekers. Hsia,(21) and Watt,(22) have pointed out that

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(19) See, for example, the comments of Martin Block, "Time Allocation in Mass Communication Research," Chap. 2 in Progress in Communication Sciences, Volume 1 Melvin J. Voight and Gerhard J. Hanneman, eds. (Norwood, N.J.:Ablex, 1979), pp. 29-49: 47.

(20) Robert Krull, William G. Husson, and Albert S. Paulson, "Cycles in Children's Attention to the Television Screen," in Communication Yearbook II B.D. Ruben, ed. (New Brunswick, N.J.: Transaction, 1978), 125-140.

(21) H.J. Hsia, "The Information Processing Capacity of Modality and Channel Performance," AV Communication Review 19 (Spring 1971): 51-75: p. 53.

(22) James H. Watt, Jr., "Television Form, Content Attributes, and Viewer Behavior," Chapter 3 in Progress in Communication Sciences, Melvin J. Voight and Gerhard J. Hanneman, eds. (Norwood, New Jersey: Ablex, 1979) Volume 1, 51-89.

many physiological studies have demonstrated the effects of sensory feeding, overloading and deprivation. Humans must process sensory information. A lack of information to process is highly aversive. Too much stimulation, on the other hand, may also be aversive.(23) There may be, in fact, some optimal level of stimulation which humans are striving for. Donohew and Tipton have suggested that individuals operate between boundaries of variety and consistency, turning away from information if it becomes monotonous (too much consistency), or if it becomes threatening (too much variety).(24) Donohew and Tipton call their paradigm activation theory, and they note its development from sensory deprivation studies.

The stimuli which television programming offers may approach or fall within this optimal level. If it does, activation theory suggests individuals would accept the programming over other competing stimuli. If it does not, then it bores, and other competing stimuli such as the call of a beer from the refrigerator, or some other channel's programming, takes over. This paradigm is addressed in the present study's first hypothesis.

Form/Structure v. Content:

From a variety of research areas comes the idea that program content is subservient to a concept we will refer to as form, or

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(23) D.E. Berlyne, Aesthetics and Psychobiology (New York: Appleton- Century-Crofts, 1971).

(24) Lewis Donohew and Leonard Tipton, "A Conceptual Model of Information Seeking, Avoiding and Processing," Chap. 8 in New Models For Mass Communication Research, Peter Clarke, ed. (Beverly Hills, Calif.: Sage, 1973): 243-268: 245.

structure. Krugman reported that the brain waves from his single subject showed a different response to different media forms (television and print), rather than to differences in content.(25) McCain and Ross found that people exhibit similar cognitive switching behaviors in similar information processing situations, even though the content of the stimulus changes.(26) They found that subjects processed similar information (i.e., TV newscasts) in a similar fashion, regardless of the varying content in the newscasts. This suggested to the authors that people bring to the news viewing situation a cognitive switching style which they employ in a systematic manner regardless of variations in news content. In some earlier work concerning consistencies in the way in which people process stimulus material regardless of changes in content, Bartlett concluded that the ways we deal with the various problems which confront us are much less varied than the problems themselves.(27) There is, in the foregoing, a suggestion of form, of structure, and of its utility in information processing. Further, does this suggest that the information processing tasks in a familiar program form, such as a newscast, can be anticipated?

How might form be operationalized? Production variables, such

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(25) H.E. Krugman, "Brain Wave Measures of Media Involvement," Journal of Advertising Research 11 (February 1971): 3-9.

(26) Thomas A. McCain and Mark G. Ross, "Cognitive Switching: A Behavioral Trace of Human Information Processing for Television Newscasts," Human Communication Research 5 (Winter 1979): 121-129: 129.

(27) F.C. Bartlett, Remembering (Cambridge: Cambridge University Press, 1932), p. 109.

as shot size, have not been shown empirically to have any systematic audience effect.(28) An even more fundamental measure may be needed. Watt and Krull offer an information theory approach to structural complexity involving a fundamental measure. They were interested in entropy, which describes the degree of randomness, or unpredictability in a set of elements.(29) The higher the entropy, the less predictable is the appearance of any unit and the more complex is the image. Watt has noted that the choice of information theory measures for describing program form was made on the assumption that the effects which program form produce in an audience are strongly linked to the information processing task presented by the program.(30) The present study adopted this concept in the development of an objectively measured variable, referred to here as static complexity. Static complexity assesses the diversity of the visual field and its organization in a TV news frame. A number of objects arranged in a predictable pattern was said to represent a less complex field than the same objects arranged more randomly.

A key theoretical assumption in the present study is that a large part of the appeal of particular programs, in this case TV newscasts, hinges on the amount of information processing they

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(28) Nikos Metallinos, "Composition of the TV Picture: Some Hypotheses to Test Forces Operating Within the Television Screen," ECTJ 27 (Fall 1979): 205-214.

(29) J.H. Watt and R. Krull, "An Information Theory Measure for Television Programming," Communication Research 1 (1974): 44-68.

(30) Watt, "Television Form, Content Attributes, and Viewer Behavior," p. 60.

require of viewers. It is suggested here that the amount of information processing required is directly related to the degree of static complexity of the TV image.

The Research Hypotheses.

The first, general hypothesis, which draws on the activation theory ideas of Donohew and Tipton,(31) and the information theory perspectives of Watt and Krull,(32) proposes that subject semantic differential ratings of television news will show a curvilinear relationship with the form complexity of the newscast image. The curvilinear nature of the hypothesized relationship suggests that there are limits to the appeal of increasing image complexity. This hypothesis is tested for using regression tests for curvilinearity.

The second hypothesis proposes that static complexity has a cumulative effect on subject responses, such that a lagged form offers a better description of the relationship between the two variables than does a cross-sectional form. The third and final hypothesis draws on the work of Krull and Husson,(33) in proposing that subjects are able to anticipate changes in the form complexity variable through the time series. This anticipation effect is seen as a variation in the dependent subject responses in advance

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(31) Donohew and Tipton, "A Conceptual Model of Information Seeking, Avoiding and Processing."

(32) Watt and Krull, "An Information Theory Measure for Television Programming."

(33) Robert Krull and William Husson, "Children's Anticipatory Attention to the TV Screen," Journal of Broadcasting 24 (Winter 1980): 35-47.

of changes in the independent form complexity variable. This anticipation effect, it is suggested, is a manifestation of the predictable form of television news. Subjects can "know" what is coming and adjust their response accordingly.

Hypotheses 1, 2, and 3 might be conceptualized as Figures 1, 2, and 3, respectively.

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Figures 1, 2, 3 about here

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The superimposition of Figure 2 on Figure 3, as shown in Figure 4, suggests a simultaneous resolution of Hypotheses 2 and 3, with all the advantages of variable control that a simultaneous solution offers. For example, this solution could resolve the question of whether the two qualities of causation and anticipation exist at the same time.(34)

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Figure 4 about here

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Method:

The static complexity variable values were obtained as follows. The "CBS News With Dan Rather" for July 16, 1981, was recorded off the air on professional broadcast recording equipment. Digitizing involved the transformation of the components of

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(34) This causality/anticipation model draws on the econometrics concept of Granger Causality in time series. See C.W.J. Granger, "Investigating Causal Relationships by Econometric Models and Cross-Spectral Methods," *Econometrica* 37 (July 1969): 424-438. A variable X is said to "Granger Cause" a variable Y, if Y can be better predicted from the past of X and Y together than the past of Y alone, other relevant information being used in the prediction.

the television image into their numerical representations. The light intensity, on a gray scale, of pixels or light points making up the image, was read off onto magnetic tape. The gray scale for the data at this point consisted of 256 gradations. These numerical representations can be reproduced on a printer to reconstruct a version of the original image. An example is displayed as Figure 5.

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Figure 5 about here

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The graphics facility used to achieve this digitizing was a minicomputer-based system (PDP11/34A) with a Grinnell 270 interactive color raster graphics/image processor, a Vector General 3405 interactive 3-D graphics processor, and hard copy plotting capability on a Versatec 1200 printer. The transfer of the image from videotape to the Grinnell image processor was done through a small industrial-type TV camera which was wired into the tape recorder. Although the Grinnell has the capability to process image arrays up to 512 by 512 pixels, the video recorder and camera used in this study could only deliver an array of 256 by 256 pixels. Despite the array size being halved, the digitized newscast took up seven 2400-foot magnetic tapes at 1600 bytes per inch data density (bpi).

One frame every five seconds was digitized throughout the newscast. Program titles and commercials were included. It was not possible to automate the digitizing so this had to be done under manual control, with consequent potential for error. Aided by a colleague and a stopwatch, the researcher would put the videotape recorder into its pause mode every five seconds, holding in pause long enough for the image processor to capture the image for digitizing. A bell was programmed into the digitizing routine to sound when the digitizing of a particular frame had been completed. At that point the videotape machine was rolled-on five seconds and then paused again to capture the next image.

The computation of static complexity compared pixel intensities with the intensities of adjacent pixels in the same picture to see if they had the same or different levels of light intensity. Imagine an image of anchorman Dan Rather reading a news story directly to the camera without any supporting visuals. There will not be as much variation in adjacent pixel levels compared to, say, footage of a battle, or of a fire, where the probability that adjacent pixels will differ in their light levels is higher. The image of Rather will show a lower entropy value than will the image of the conflagration.

The formula used to compute H, the static complexity entropy, was:(35)

$$H_{static} = \sum_{ij} H_{ij}$$

$$H_{ij} = -(p_{ij} \log_2 p_{ij}) - (q_{ij} \log_2 q_{ij})$$

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(35) This information theory entropy formula was drawn from Alicia J. Welch and James H. Watt, Jr., "Visual Complexity and Young Children's Learning From Television," Human Communication Research 8 (Winter 1982): 133-145: 136.

$$q_{ij} = 1 - p_{ij}$$

$p_{ij}$ = percent of pixels adjacent to pixel $_{ij}$ with differing light intensity

$i$ = row number of pixel

$j$ = column number of pixel

For the purposes of this study "adjacent" pixels were regarded as the four pixels surrounding the target pixel. Thus they are the two adjacent to the target pixel in the row and the two adjacent in the column. In instances where the target pixel was against the edge of the screen, "adjacent" pixels which actually did not exist, were ignored.

The Dependent Variable:

The dependent variable consisted of a set of time sampled, scaled data, gathered in a reponse laboratory from 110 subjects who viewed the TV news material being studied. Subject reponses were recorded every 15 seconds throughout the newscast. This was the smallest interval the response machinery could reliably deliver.

The response equipment used was installed in a University classroom. There were 40 response stations. Each station had a five-button key-pad connected to an analyzer, which in turn was connected to a teletypewriter, a paper tape punch, and a computer. Subjects were randomly assigned one scale from the nine scales used, and were asked to make judgments of the TV material on their scale throughout the newscast. The scales had five decisions points, very high through very low, which corresponded with the five button controls at each response station. The nine scales were selected in such a way that three each had been shown in previous research to load on each of three dimensions generally identified in semantic differential work.(36) These dimensions have been named evaluation, potency, and activity.(37) The scale assignment can be seen in Table 1.

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Table 1 about here .

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Data processing and analysis was done using utilities available in the Statistical Package for the Social Sciences (SPSS),(38) and in SHAZAM.(39)

## Results

### The Subjects:

The subjects in this study were primarily college students. Of the 110 persons involved as subjects, 93 were students and 17 were non-students. Fifty-two of the students were journalism majors, 19 were radio, television and film majors and six were advertising majors. Of the remaining students, seven were business and marketing majors, and the rest nominated psychology, education,

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(36) The nine scales were drawn from Penn, "Effects of Motion and Cutting Rate in Motion Pictures."

(37) See generally, "The Dimensionality of the Semantic Space," Chapter 2 in Osgood, Suci, and Tannenbaum, The Measurement of Meaning, pp. 31-75.

(38) Norman H. Nie et al, SPSS: Statistical Package for the Social Sciences 2d ed. (New York: McGraw-Hill, 1975).

(39) K.J. White, "A General Computer Program for Econometric Methods--SHAZAM," Econometrica 46 (January 1978): 239-240.

philosophy, government and law as their majors.

Across the total subject group there were 62 females (56 percent of the total), and 48 males (44 percent). Their ages ranged from 18 to 58 years. None of the subjects had less than some college education. The 17 non-students represented professions such as librarian, lawyer, engineer, architect, and public education administrator.

Table 2 shows a cross tabulation of scale type assignment by subject ages.

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Table 2 about here

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The nine scales used had been selected a priori on the assumption they grouped into the three dimensions of evaluation, activity and potency. Prior research has been noted, hoever, which suggests that subject ratings of audio-visual material might emphasize the activity and potency dimensions at the expense of the evaluation dimension.

Pearson correlation and factor analysis was done on the scale response data to test whether this a priori grouping was an appropriate characterization of the data. This appeared not to be case. At this point in the analysis a contemporaneous association between the two variables was assumed. That is, no time lags were considered. Table 3 shows a Pearson correlation coefficient matrix for the nine scales, all of which proved to be highly correlated with each other. Most correlations were significant at the .001 level, one was significant at the .01 level. From this, one might conclude that the three *a priori* dimensions would also be highly intercorrelated, and Table 4 shows this to be so. Each correlation in Table 4 was significant at the .001 level.

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Tables 3 and 4 about here

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Table 5 shows the results of a factor analysis of the correlation matrix presented in Table 3.

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Table 5 about here

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The evaluation grouping of Scales 1, 2, and 3 did not dominate the first factor. Scale 3 (Good-Bad) did load quite heavily on both Factors 1 and 2. But the most impressive set of loadings on Factor 1 were those of Scales 7, 8, and 9. This grouping had made up the *a priori* potency dimension. These three scales were dominant throughout the analysis. Also loading heavily on the first factor, were two scales from the *a priori* activity grouping, Scales 5 and 6.

It appeared, therefore, that for the program as a whole (commercials included), the predominant dimension along which subject judgments were made was that of a potency/activity combination. This dimension (Factor 1) accounted for nearly 44 percent of the total variance, twice as much as that of the second factor.

Using an arbitrarily set cutoff loading level of 0.5, it is more difficult to interpret Factors 2 and 3. It would appear that an element of the evaluation grouping does appear in the second factor (Scale 1, Positive-Negative and Scale 3, Good-Bad), while an evaluation remnant (Scale 2, True-False), and an activity remnant (Scale 6, Fast-Slow), show up in the third factor.

Scale Reliability:

The correlations and factor analysis just reported suggest that the *a priori* selected scale groupings did not meet the validity and reliability expectations originally held for them. Instead, the factor analysis suggested that other combinations of scales which emphasized the activity and potency dimensions might more accurately reflect the response behaviors of the subjects.

A reliability test for the three *a priori* selected dimensions and a new potency-activity dimension called Dynamism are reported in Table 6.

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Table 6 about here

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Generally one would seek to obtain a reliability coefficient in the range 0.70 to 1.00. The new scale (Dynamism) offered a Cronbach's alpha of .9549 for the complete newscast, and an alpha of .9278 for the newscast with commercials excluded (N=92). This dimension was accepted as adequately representing the total scale set. The dynamism dimension, therefore, became the dependent variable throughout subsequent statistical computations.

Figures 6, 7, 8 and 9 are plots of the static complexity and subject responses across time. Note that the static complexity data has been collapsed from its original five second sampling interval to one of fifteen seconds in order to align the series with the fifteen second intervals of the subject responses. Note, too, that the subject responses are an averaged sum of the ratings of Scales 3,5,6,7,8 and 9, which constitute the new dimension of dynamism.

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Figures 6,7,8 and 9 about here

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Inspection of the subject response series in Figures 6,7,8 and 9 show that subjects consistently offered low ratings opposite commercials. This consistency in subject responses had the effect of reducing the variance across the series for the complete newscast. In order to conserve variance the values of static complexity and subject reponses in the intervals where commercials occurred were dropped from subsequent analyses. This left 92 intervals in each of the series. No allowance was made for this missing data, although computations continued to be done on both the complete and reduced data sets as a check.

Specification of the Simple Time Series:

The time series of the two variables appear to take an autoregressive, first order form (AR1). This conclusion is drawn from Figure 10, the correlogram illustrating the autocorrelation functions of the two series.

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Figure 10 about here

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The autocorrelation function describes the correlation between the first data point in the series and subsequent data points. It indicates how much interdependency there is in the series. From Figure 10, it is apparent that there is a sharp drop to near zero in the autocorrelation functions for both time series. The complexity variable drops to zero more sharply than does the subject responses, suggesting that the subject responses are a smoother series. Beyond the fourth lag, there appears to be some fluctuation in the autocorrelation coefficients of both series. For example, at the tenth lag (150 seconds), there appears to be a peak in both series. At this time lag the series are more highly correlated with the first data point than are adjacent points. These peaks suggest that one might expect high or low values of static complexity and subject reponses at approximately 150 second intervals, and this may be evidence of cycles in the series.

It was concluded that both series were generated by white noise processes, and that a reasonable model for each might be to apply the autocorrelation function of the first lag as the regression coefficient in the two respective simple models, as follows:

Static complexity $h_t = a_t + .3622h_{t-1}$

where $h_t$ is the predicted value of static complexity at time t, $a_t$ is the intercept value at time t

Subject responses $s_t = a_t + .4175s_{t-1}$

where $s_t$ is the predicted value of the subject responses at time t, and $a_t$ is the intercept value at time t

These two models suggest that the subject response series is a more predictable series than that of static complexity. At 15 seconds lag (one response interval) one can predict subject responses, on average, with 17 percent precision (.4175 squared), and static complexity with 13 percent precision (.3622 squared). Neither of these numbers is particularly impressive in and of itself. They do serve as a reminder, however, that a certain amount of constraint appears to be imposed on the variation in each variable even before any other program variables are considered.

The Specification of the Transfer Function Model:

The hypothesised model is as follows:

$$Y_i = a + bX_i + e_i$$

where $Y_i$ is the ith observation of the dependent variable, which in this case is the subject responses, a is an intercept term designating the point where the regression line will intercept with the Y axis, and b indicates the slope of the regression line, thereby explaining how much Y changes with unit change in X. X is the independent variable. In this case, X is the form complexity attribute being studied. e indicates the presence of error. The error term is a reminder that the prediction equation by itself (i.e., $Y = a + bX$) does not predict Y perfectly. The predictions of Y do not fall exactly on the regression line, and the reason they do not is because of error incorporated in the term e.

Figure 11 is a scatterplot of the subject responses and static complexity with a regression line and 95 percent confidence interval fitted. The regression line has a slight, negative, slope.

The specification of this line is as follows:

$$Y = 3.740 - 0.0002X$$

Note that a contemporaneous association between the two variables is still being assumed.

---

Figure 11 about here

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This regression showed significance ($F=4.203$, $df=1,90$, $p<.05$), the static complexity coefficient was significant ($t=2.050$, $df=90$, $p<.01$), and the R-square accounted for was 5.8 percent. This regression also showed first order autocorrelation in its residual plot (Rho=.397, Durbin-Watson's d=1.2046). A plot of the residuals, which show classic, positive, autocorrelation, is shown as Figure 12. This autocorrelation has probably inflated what little R-square this regression has obtained.

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Figure 12 about here

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The regression line in Figure 11 is, of course, linear. But Hypothesis 1 suggested that the data were distributed in a curvilinear fashion. Table 7 summarizes two dummy variable tests for curvilinearity in the data for both the complete newscast (N=116 intervals), and for the newscast without commercials (N=92 intervals). None of the tests showed significance, leading to the conclusion that the data showed a high degree of linearity, and that Hypothesis 1 was not supported.

Table 7 about here

Hypothesis 2 proposed that a cumulative effect might be found in the relationship between the two variables. A model was next developed which lagged the independent variable back in time. The model was specified as follows:

$$Y_t = a + b_0 X_t + b_1 X_{t-1} + b_2 X_{t-2} + \ldots b_k X_{t-k} + e_{kt}$$

where t=time (in this case response interval) and the other terms are those defined earlier.(40)

Unfortunately theory is not very helpful in specifying what particular lag value might be appropriate, so a range of lag values was tried. A model incorporating ten lags of the static complexity variable did show significance ($F=2.836$, $df=12,69, p<.01$), and the tenth lag showed a significant regression coefficient ($t=2.6966$, $df=69$, $p<.01$). This model showed an R-square of 33.03 percent and an adjusted R-square of 21.38 percent. This high variance accounted for was probably inflated because the model still showed significant autocorrelation. Control of this autocorrelation was required.

Having now developed the idea that a significant lag may exist in the static complexity data at about 150 seconds, an attempt was

(40) For an introduction to the lagging of both independent and dependent variables, see Charles W. Ostrom, Jr., Time Series Analysis: Regression Techniques (Beverly Hills, Calif.: Sage, 1978).

then made to incorporate lags of the dependent variable in the model. This brought the model into what is referred to as an autoregressive state. The rationale for developeing this model was that theory has already been proposed that subjects interact with television newscasts to the extent that effects may actually cumulate. If this is so, then a model incorporating lags of the dependent variable should account for more variance than a simple model which assumes only a contemporaneous relationship between the independent and dependent variables. The model specified was as follows:

$$Y_t = a + b_0 Y_t + b_1 Y_{t-1} \ldots + b_k Y_{t-k} + b_0 X_t + b_1 X_{t-1}$$

$$\ldots\ldots + b_k X_{t-k} + e_{kt}$$

where $Y_{t-k}$ is the lagged endogenous variable and the other terms are those defined earlier.

There are some serious theoretical problems to be overcome when lagged dependent variables are brought into the regression model. Autocorrelation had already been a problem in the present study with the lagged independent variable. In the autoregressive model the error term can no longer be considered to be random, so autocorrelation must be controlled. To do this a generalized least squares procedure incorporating a modified Cochrane-Orcutt differencing-iterative procedure, as developed by Beach and MacKinnon, and available in the SHAZAM computing package, was used.(41) Following this procedure the model was summarized as follows:

$$Y_t = -4.732 - .148Y_{t-7} + .116Y_{t-10} + .147X_{t-3}$$
$$\qquad (-1.357^{*}) \quad (1.250^{*}) \quad (1.857^{**})$$

$$+ .116X_{t-6} + .164X_{t-9} + .180X_{t-10}$$
$$(1.704^{**}) \quad (2.569^{**}) \quad (2.240^{**})$$

$F=3.191$, $df=20,50$, $p<.001$

Adjusted R-square = 31.01 percent

Durbin-Watson h = 1.997

The numbers in parentheses are coefficient t-ratios, and the asterisks indicate significance levels obtained as follows:

$* = p<.05$, $**p<.01$

It was now apparent that the incorporation of time lags into this one-way model had significantly improved the predictive capacity of the model. At the beginning of the model specification process the preliminary OLS model had an R-square value of 5.8 percent. The GLS model now specified had an adjusted R-square value of 31.01 percent. This finding supports Hypothesis 2, which argued that the lagged form of the relationship between static complexity and subject responses would account for more variation than the cross-sectional form of the relationship.

A clos. inspection of the t-ratios for the regression coefficients suggested that there was a cumulating lag of about three

(41) C. Beach and J. MacKinnon, "A Maximum Liklihood Procedure for Regression With Autocorrelated Errors," Econometrica 46 (1978): 51-58. The Cochrun-Orcutt method is described in J. Kmenta, Elements of Econometrics (New York: MacMillan, 1971), p. 288.

response intervals (45 seconds) for each of the two variables. The pattern in the static complexity variable was a pronounced one, manifesting as a sequence of 45 seconds, 90 seconds, then a 135 and 150 second combination lag. Less pronounced was the order displayed by the dependent variable of 15, 60, 105 and 150 second lags. It appeared from this model that the dependent variable was tending to show a pattern of a lag effect manifested one response interval (15 seconds) after the independent variable.

Hypothesis 3 proposed a causality/anticipation relationship between the two variables. In order to establish this a simultaneous solution of two prediction equations, one for X on Y and the other for Y on X, were computed. The procedure used, the Zellner GLS procedure for seemingly unrelated equations, allows for the simultaneous fitting of the regression equations.(42) Table 8 summarizes this Direct Granger causality/anticipation test.

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Table 8 about here

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The significant F-statistics allow the rejection of the respective null hypotheses and the inference of the alternate relationships between X and Y as specified in Hypothesis 3. That is, there is a Granger relationship between static complexity and subject responses in the system. This suggests that past histories of X and Y do "predict" Y and X respectively. Lags of

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(42) A. Zellner, "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias," Journal of the American Statistical Association 57 (1962): 348-368. The SHAZAM computing package offers the Zellner GLS estimation procedure.

the static complexity variable showed significant coefficients at (t-1)* and (t-10)**.(43) Lags of the subject response variable showed significant regression coefficients at lags of (t-1)**, (t-2)*, (t-3)**, (t-4)**, (t-7)*, and (t-8)*.

Figure 13 diagrams the time lags which the Direct Granger test showed to have a significant effect on the present values of X and Y. The coefficients noted are the appropriate standardised beta coefficients.

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Figure 13 about here

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The signs on the coefficients of the lagged variables in Figure 13 indicate the direction of their relationship with the present values of static complexity and subject responses. The coefficient for the ten-interval lag of the static complexity variable is positive, suggesting that the value of the subject response at time t will move in the same direction as the static complexity moved 150 seconds previously. The coefficient for static complexity lagged back one interval (t-15 seconds) has a negative relationship with the value of the present subject response, suggesting that the values for subject responses at time t will move in the opposite direction to that of the preceding lag's static complexity.

In the case of the anticipation effect identified in the sub-

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(43) * denotes the regression coefficient at that lag was significant at $p<.05$. ** denotes that the coefficient was significant at $p<.01$. df=59. Time is in units of 15 second response intervals.

ject responses, there is a consistent pattern of negative regression coefficients. This suggests that subjects seem to anticipate that future movement in static complexity values will be in the opposite direction to the movement of their responses in the lagged states.

Since 15 seconds was the minimum time available in the response machinery used in this study it is likely that there are effects below this time period which the study could not address. But the significant 150-second lag in the static complexity series does stand out. Although diagnostic testing of the model suggested that seasonality was not a problem, the fact that the only significant lag in the independent variable beyond the first lag was one at 150 seconds suggests that perhaps there is at least one cycle in the data which requires attention. This finding of a 150-second lag tends to corroborate that of Krull and Paulson, who found childrens' attention reached its highest and/or lowest levels at 150 second intervals in the viewing of the program "The Electric Company."(44) Audience ratings of a newscast, the present study suggests, show a similar pattern.

## Summary and Conclusions

This study has considered some associations between two time series. Those series were:

1. An electronically estimated form complexity variable derived from pixel light intensity ("static complexity"), and

(44) Robert Krull and Albert S. Paulson, "Time Series Analysis in Communication Research," Chapter 12 in Strategies for Communication Research Paul M. Hirsch, Peter V. Miller, and F. Gerald Kline, eds. (Beverly Hills, Calif.: Sage, 1977), pp. 231-256.

measured throughout a network TV newscast.

2. Audience evaluations measured throughout that same newscast ("subject responses").

Taking time into account in this manner allowed for the exploration of a hypothesised causality and anticipation system between the two series. The incorporating of time lags revealed two particular features:

1. There was significant evidence of cumulation, reaching back as far as 150 seconds, in the effect the static complexity had on subject responses. Subject anticipation effects predicted by the study's third hypothesis were revealed up to 120 seconds back in time.

2. The form complexity variable considered here, static complexity, when lagged back 150 seconds and tested against an autoregressive form of the subject responses, accounted for some 31 percent of the variance in those subject responses. In contrast, a preliminary model developed earlier in the study, which assumed a contemporaneous association between the two variables, accounted for only six percent of the variance. This possibility had been predicted by the study's second hypothesis.

Some 69 percent of the variation in the lagged model remains unaccounted for, however, so the 31 percent finding may not seem particularly impressive at first glance. But this 31 percent accounted for does suggest that attempts to change audience evaluations of TV news by modifying other non-form variables in the newscast may not be effective unless static complexity is addressed as well. Further, the improvements obtained in the variation accounted for in the model, through the use of lagged variables, suggests that attempts at changing audience ratings of TV news should also take into account previous values of the variables studied.

This conclusion suggests that program context may be an important element in the analysis of audience reactions, as measured here, to a network TV newscast. The researcher needs to know the context and patterns in which program variables of interest are placed. This calls into question the validity of studies which assume or imply audience effects from categories of program quality presented in isolation from the context in which those qualities arose. At least for the form complexity variable studied here, cross-sectional correlations of contemporaneous associations may not make as convincing a case for a relationship as may have been earlier believed.

An irony which emphasizes this problem of context is the suggestion here that lags noted as having an effect on a variable's present value may well reach further back in time than the duration of the news story currently being viewed. In other words, subjects' responses to the present story may be qualified by their responses to earlier stories. And those earlier stories may have covered a different subject from that of the present story.

This study's findings also call into question the utility of some traditional content analysis approaches. Content attributes may be a necessary component of a predictive behavioral model, but they are not sufficient. The amount of variation accounted for by the form complexity variable used here would suggest that a complete model should take form complexity into account. Newscast change may not be wholly effective if attention is given over only to the modification of content attributes.

This study's first hypothesis proposed a curvilinear relationship between static complexity and subject responses such that subjects would rate static complexity increasingly up to a certain optimal level and beyond which their ratings of it would decrease. This hypothesis was not supported by the data. But it is argued here that this may have been due to limitations of the data set tested rather than in the hypothetical concept. The data set's range may have been too limited to demonstrate the curvilinearity hypothesised. Perhaps curvilinearity could be demonstrated if a broader range of complexity values were offered to subjects.

What was demonstrated in the data, however, was evidence of a linear relationship of negative slope (see Figure 11). If the hypothesised curvilinear relationship does still hold in the more general case, it may be that the present data set could only demonstrate a small, apparently linear, section of the larger curvilinear relationship. In other words, although the hypothesis was not supported by the present data, it may still be a valid concept. Further research across a broader range of TV material is needed to clarify this hypothesised relationship. Finally, it will be recalled that the test of Hypothesis 1 did not involve time lags in the variables. The findings from the tests of Hypotheses 2 and 3 suggest that if lags were incorporated in the test of Hypothesis 1 a more meaningful result might be obtained.

Effecting this was beyond the resources of the present study.

Consequent on the testing of Hypothesis 1, Figure 1 might now be modified to incorporate the admittedly speculative results of this test. A modified Figure 1 is now offered as Figure 14.

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Figure 14 about here

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Krull and Watt have proposed locating some noncommercial TV programming on the ascendent side of the suggested optimal point in the figure.(45)

In considering the findings of the Granger causality/anticipation test of Hypothesis 3 a caution is appropriate. Pierce and Haugh warn against the misinterpreting of spurious Granger causal orderings in a model where Y exogeneity may appear in an empirical relationship, when in fact the structural relationship is one of causality from X to Y only.(46) It could be argued that this is the case in the present study. An example of Y exogeneity has apparently been revealed. This apparent exogeneity is interpreted here as support for the conclusion that TV news subjects do "lead", or anticipate, changes in the static complexity variable, and that the Direct Granger causality test is able to detect this anticipation. Generalizing beyond the data, it might be said that confirmation is suggested here for the TV newscast being a

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(45) R. Krull and J.H. Watt, "Television Program Complexity and Ratings," paper presented at the American Association for Public Opinion Research Conference, Chicago, Illinois, 1975.

(46) D.A.Pierce and L.D. Haugh, "Causality in Temporal Systems: Characterizations and a Survey," Journal of Econometrics 5 (1977): 265-293, p. 291.

predictable phenomenon, such that its structural conventions (in terms of form), are familiar to the audience. Viewers can anticipate when changes are coming and react accordingly.

Future research might look to extending the idea of form to that of dynamic visual visual complexity (complexity <u>across</u> a series of frames), and to audio complexity. The information processing approach considered here might also be extended to content variables. A further research approach might be to go beyond the gross level of analysis taken in the present study and look to the effects different newscast components (e.g., anchor-only material, individual tape stories) might have on subjects. Of course, there is also a need to go beyond the use of college students as subjects and test the ideas here with a more typical TV network news audience.

TABLE 1

The Scale Assignment

| Dimension | Scale | No. Subjects |
| --- | --- | --- |
| Evaluation | positive-negative | 12 |
| | true-false | 12 |
| | good-bad | 12 |
| Potency | strong-weak | 12 |
| | potent-impotent | 12 |
| | hard-soft | 12 |
| Activity | active-passive | 12 |
| | excited-calm | 13 |
| | fast-slow | 13 |
| | Total subjects | 110 |

TABLE 2

Cross Tabulation of Scale Type Assignment
By Subject Age

| Scale Type | Age (in years) 0-19 | 20-24 | 25-34 | 35 plus | Total |
|---|---|---|---|---|---|
| Positive -Negative | 1 | 6 | 3 | 2 | 12 |
| True-False | 1 | 6 | 4 | 1 | 12 |
| Good-Bad | 0 | 6 | 5 | 1 | 12 |
| Active-Passive | 2 | 6 | 1 | 3 | 12 |
| Excited -Calm | 0 | 10 | 2 | 1 | 13 |
| Fast-Slow | 1 | 8 | 2 | 2 | 13 |
| Strong -Weak | 0 | 8 | 4 | 0 | 12 |
| Potent-Impotent | 0 | 6 | 5 | 1 | 12 |
| Hard-Soft | 0 | 8 | 4 | 0 | 12 |
| Total | 5 | 64 | 30 | 11 | 110 |

TABLE 3

Pearson Correlation Coefficient Matrix For
Nine Scales Across Complete Program (N=116)

| Scale | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1 | - | | | | | | | |
| 2 | .565 | | | | | | | |
| 3 | .613** | .671** | | | | | | |
| 4 | .596** | .705** | .655** | | | | | |
| 5 | .363** | .681** | .692** | .686** | | | | |
| 6 | .461** | .786** | .731** | .707** | .820** | | | |
| 7 | .398** | .598** | .782** | .664** | .844** | .756** | | |
| 8 | .453** | .661** | .793** | .678** | .836** | .795** | .857** | |
| 9 | .213* | .574** | .635** | .597** | .844** | .703** | .803** | .791** |

* p<.01
** p<.001

Key:

Scale 1 = Positive-Negative
Scale 2 = True-False
Scale 3 = Good-Bad
Scale 4 = Active-Passive
Scale 5 = Excited-Calm
Scale 6 = Fast-Slow
Scale 7 = Strong-Weak
Scale 8 = Potent-Impotent
Scale 9 = Hard-Soft

TABLE 4

Pearson Correlation Coefficient Matrix of *A Priori* Selected Evaluation, Activity, and Potency Dimensions Across Complete Program (N=116)

| | Evaluation | Activity | Potency |
|---|---|---|---|
| Evaluation | - | | |
| Activity | .803* | - | |
| Potency | .710* | .884* | - |

* = p<.001

Evaluation = Scale 1 = Positive-Negative
Scale 2 = True-False
Scale 3 = Good-Bad

Activity = Scale 4 = Active-Passive
Scale 5 = Excited-Calm
Scale 6 = Fast-Slow

Potency = Scale 7 = Strong-Weak
Scale 8 = Potent-Impotent
Scale 9 = Hard-Soft

TABLE 5

Factor Matrix of Scale Response Means From Entire Program (N=116 Response Intervals) (Varimax Rotation with Kaiser Normalization)

| Scales | Factor 1 | Factor 2 | Factor 3 |
|---|---|---|---|
| Pos-Neg | .1152 | *.8627 | .2178 |
| True-False | .3843 | .4401 | *.6845 |
| Good-Bad | *.6339 | *.5678 | .2360 |
| Active-Pass | .4803 | .4857 | .4528 |
| Excited-Calm | *.8019 | .1832 | .4462 |
| Fast-Slow | *.6236 | .3233 | *.5749 |
| Strong-Weak | *.8718 | .3041 | .1952 |
| Potent-Impot | *.8073 | .3481 | .2914 |
| Hard-Soft | *.8352 | .0537 | .3329 |
| Eigenvalues** | 3.9352 | 1.8512 | 1.5405 |
| Total Variance Accounted for by Each Factor*** | 43.7% | 20.5% | 17.1% |

Total Variance Accounted For = 81.3%

* = Factor loadings > 0.5
** = Sum of the squares of the loadings on each factor
*** = Eigenvalue divided by number of scales, as percent

TABLE 6

Reliability Coefficients (Cronbach's Alpha) For *A Priori* Selected Scale Groupings and New Activity-Potency Dimension, Dynamism (N=116, 92)

| Dimension | Number of Scales | N | df | Alpha |
|---|---|---|---|---|
| Evaluative | 3 | 116* | 2,114 | .8253 |
| | 3 | 92** | 2,90 | .7835 |
| Activity | 3 | 116 | 2,114 | .8802 |
| | 3 | 92 | 2,90 | .7605 |
| Potency | 3 | 116 | 2,114 | .9284 |
| | 3 | 92 | 2,90 | .8967 |
| Dynamism | 6 | 116 | 5,111 | .9549 |
| | 6 | 92 | 5,87 | .9278 |

* N represents complete newscast, including commercials

** N represents complete newscasts, excluding commercials

Evaluation = Scale 1 = Positive-Negative
Scale 2 = True-False
Scale 3 = Good-Bad

Activity = Scale 4 = Active-Passive
Scale 5 = Excited-Calm
Scale 6 = Fast-Slow

Potency = Scale 7 = Strong-Weak
Scale 8 = Potent-Impotent
Scale 9 = Hard-Soft

Dynamism = Scale 3 = Good-Bad
Scale 5 = Excited-Calm
Scale 6 = Fast-Slow
Scale 7 = Strong-Weak
Scale 8 = Potent-Impotent
Scale 9 = Hard-Soft

TABLE 7

Summary Table of Dummy Variable OLS Curvilinearity Test of Null Hypothesis That There is No Difference Between the Regression Fits in the Distribution of Static Complexity and Subject Response Data

| Population | F-statistic 3 Dummy Variables | F-statistic 5 Dummy Variables |
|---|---|---|
| Complete newscast (N=116) | 1.228 (df=2,113) | .460 (df=4,111) |
| Newscast with Commercials excluded (N=92) | .477 (df=2,89) | .295 (df=4,87) |

TABLE 8

Summary Table of Direct Granger Causality Test of The Null Hypothesis that There is No Causal Relationship Between Static Complexity and Subject Responses

| Test | F-statistic | df | Signif. level | Durbin-Watson h | System R-square |
|---|---|---|---|---|---|
| Exogeneity of X (X-->Y) | 3.956 | 10,118 | $p<.001$ | 1.995 | 74.64% |
| Anticipation of Y (X<--Y) | 2.841 | 10,118 | $p<.01$ | 1.942 | |

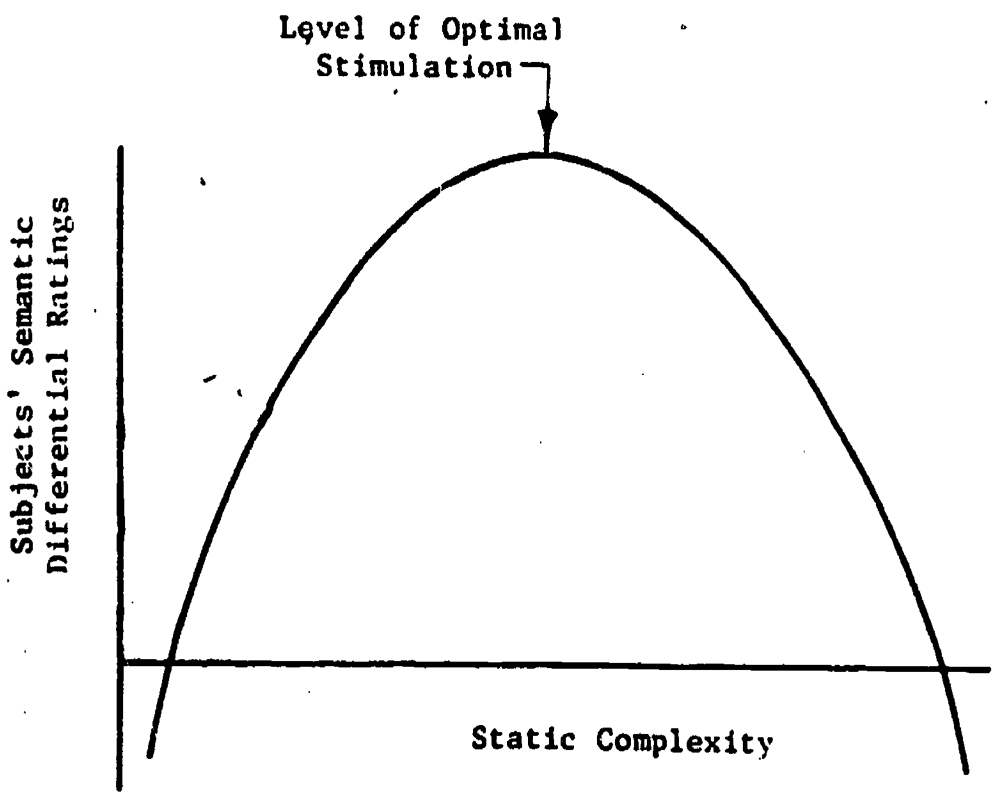
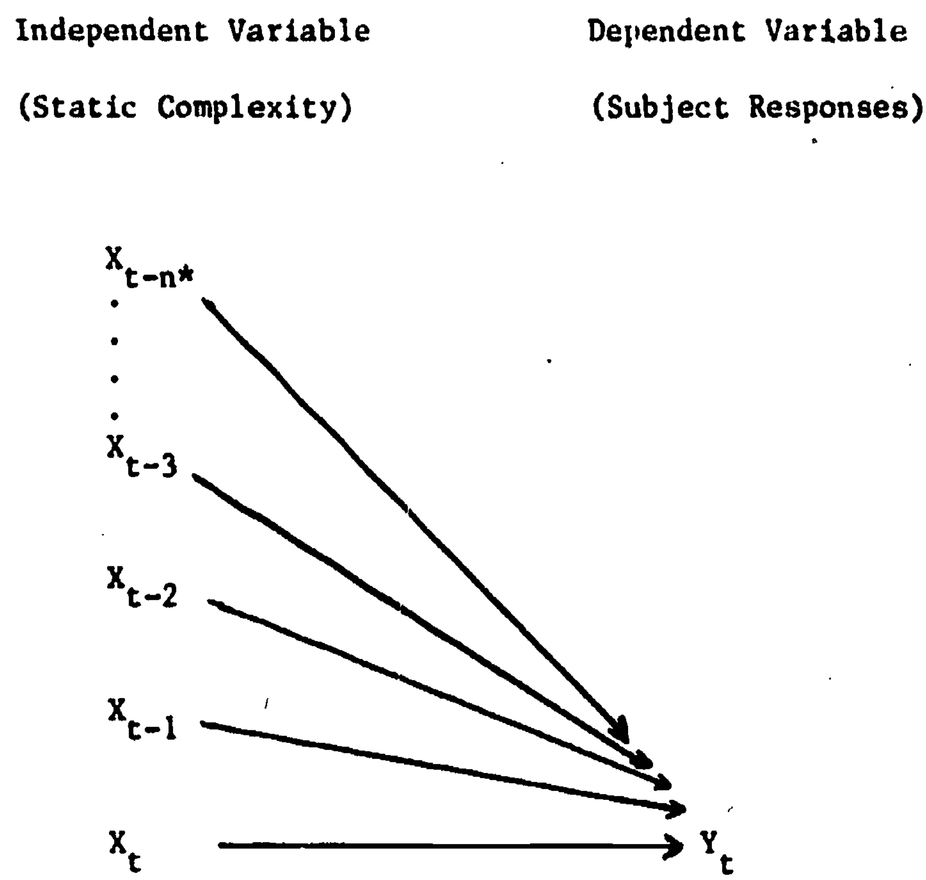



Figure 1: Hypothesized Relationship Between Subject Semantic Differential Ratings and the Static Complexity of TV News Material

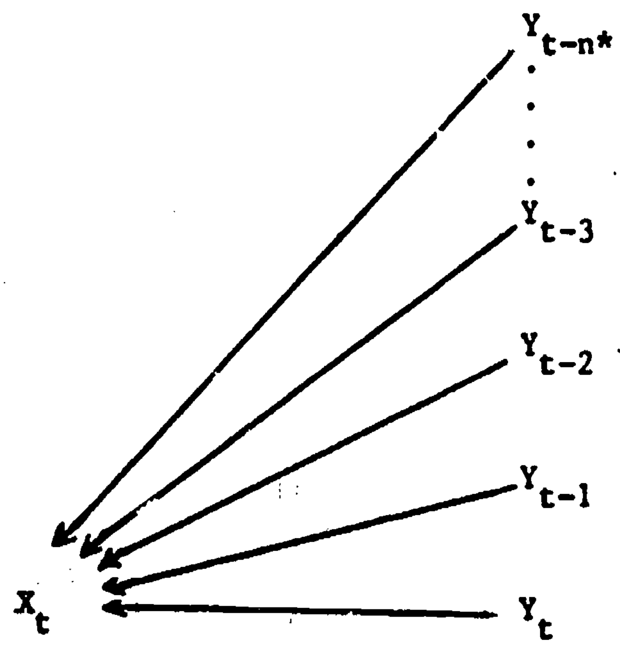



* t = time
n = number of time intervals lagged

Figure 2: Diagram of the Relationship Proposed in Hypothesis 2 Between Static Complexity Lagged and Subject Responses

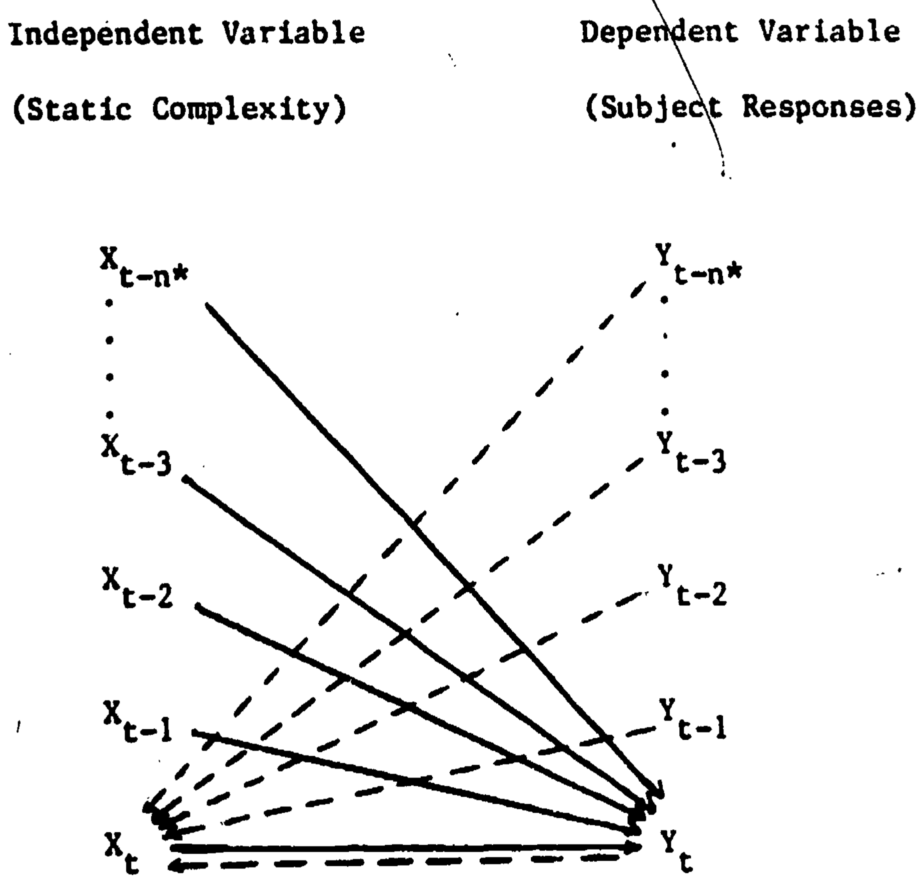
Independent Variable (Static Complexity)

Dependent Variable (Subject Responses)




* t = time
n = number of time intervals lagged

Figure 3: Diagram of the Relationship Proposed in Hypothesis 3 Between Subject Responses Lagged and Static Complexity




* t = time
n = number of time intervals lagged

Figure 4: Superimposition of Figure 1-3 on Figure 1-4 to Diagram Mutual "Causation"-Anticipation Model

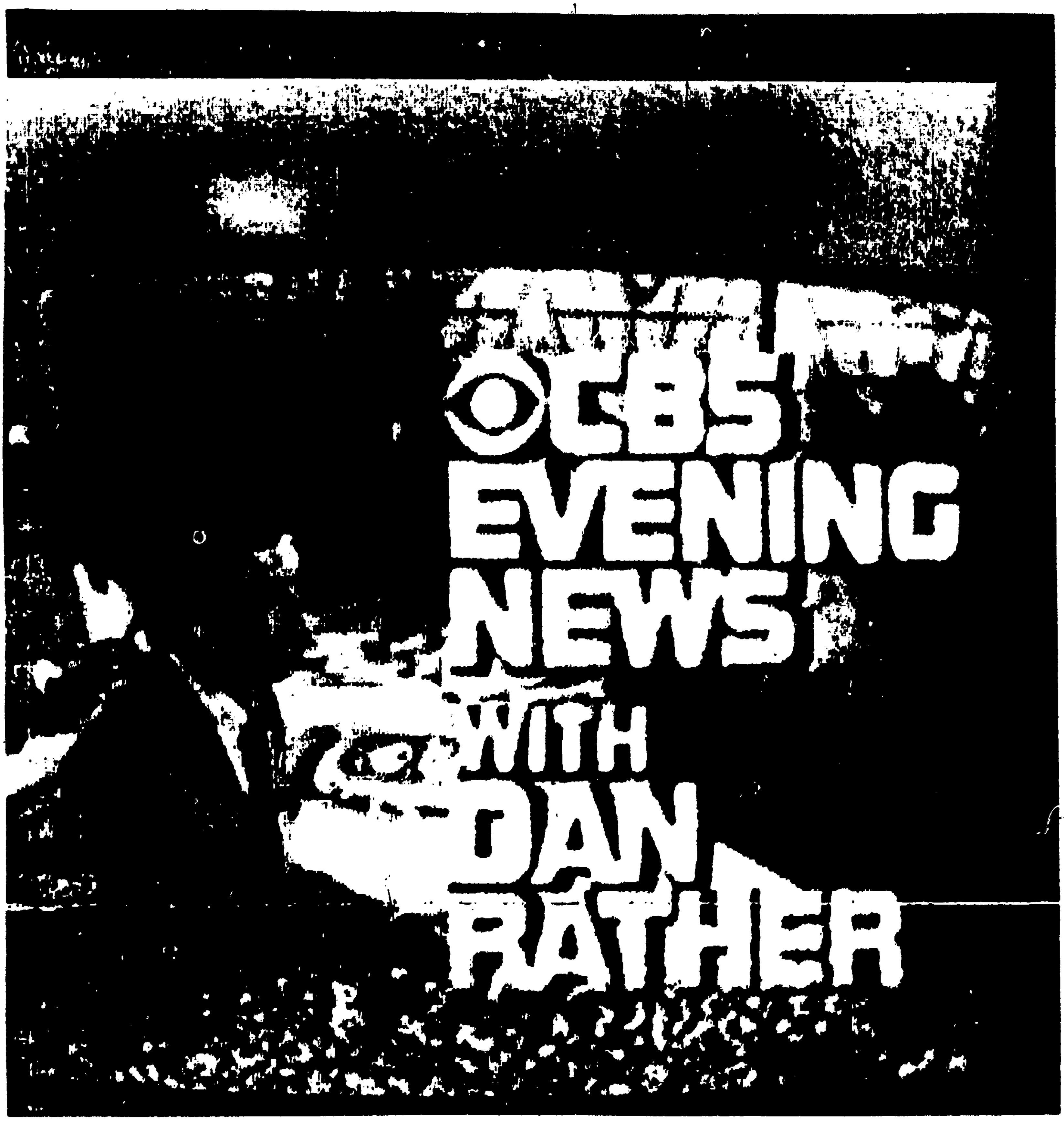
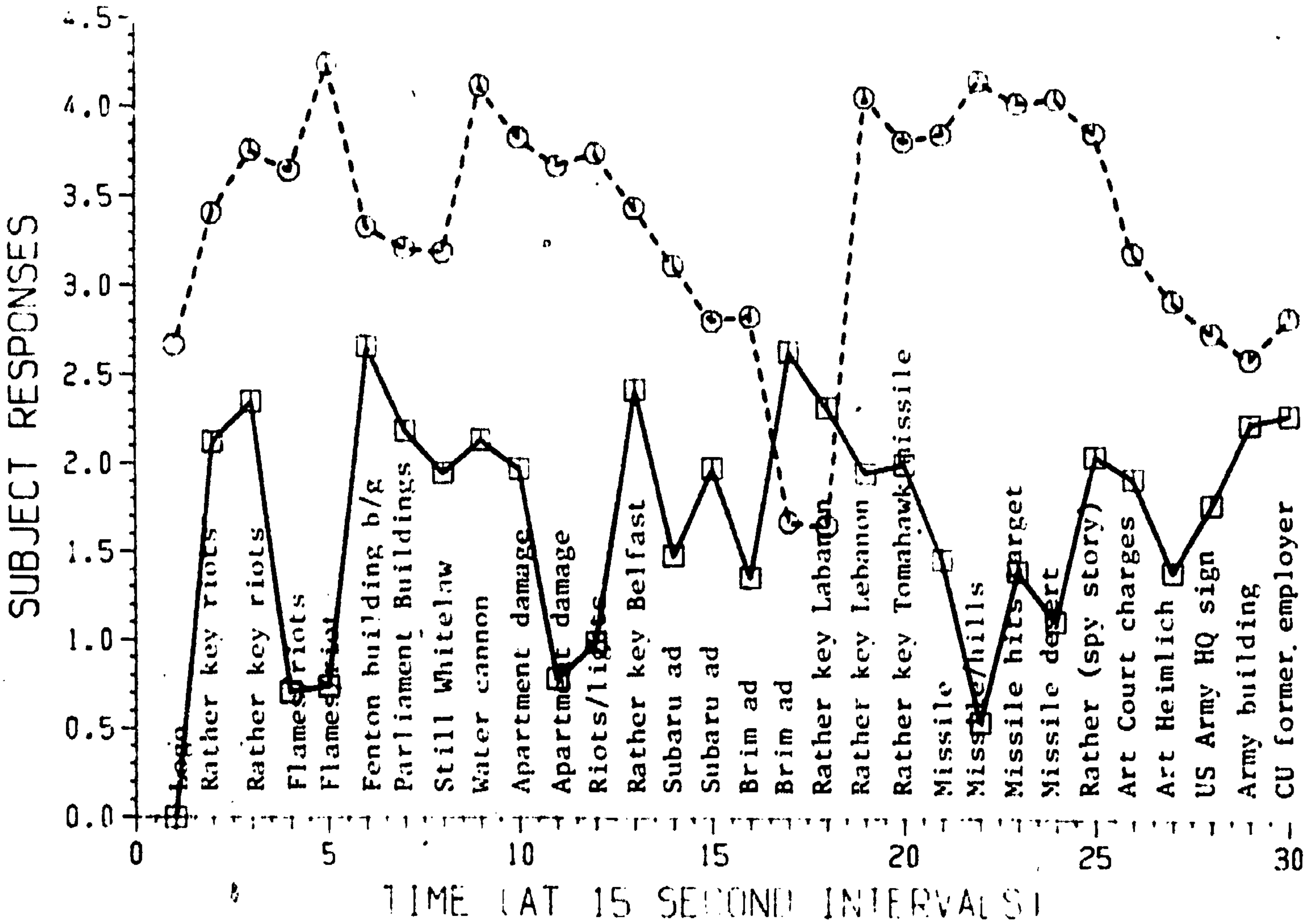



Figure 5: An example of the printed output of a digitized frame from a TV news program.

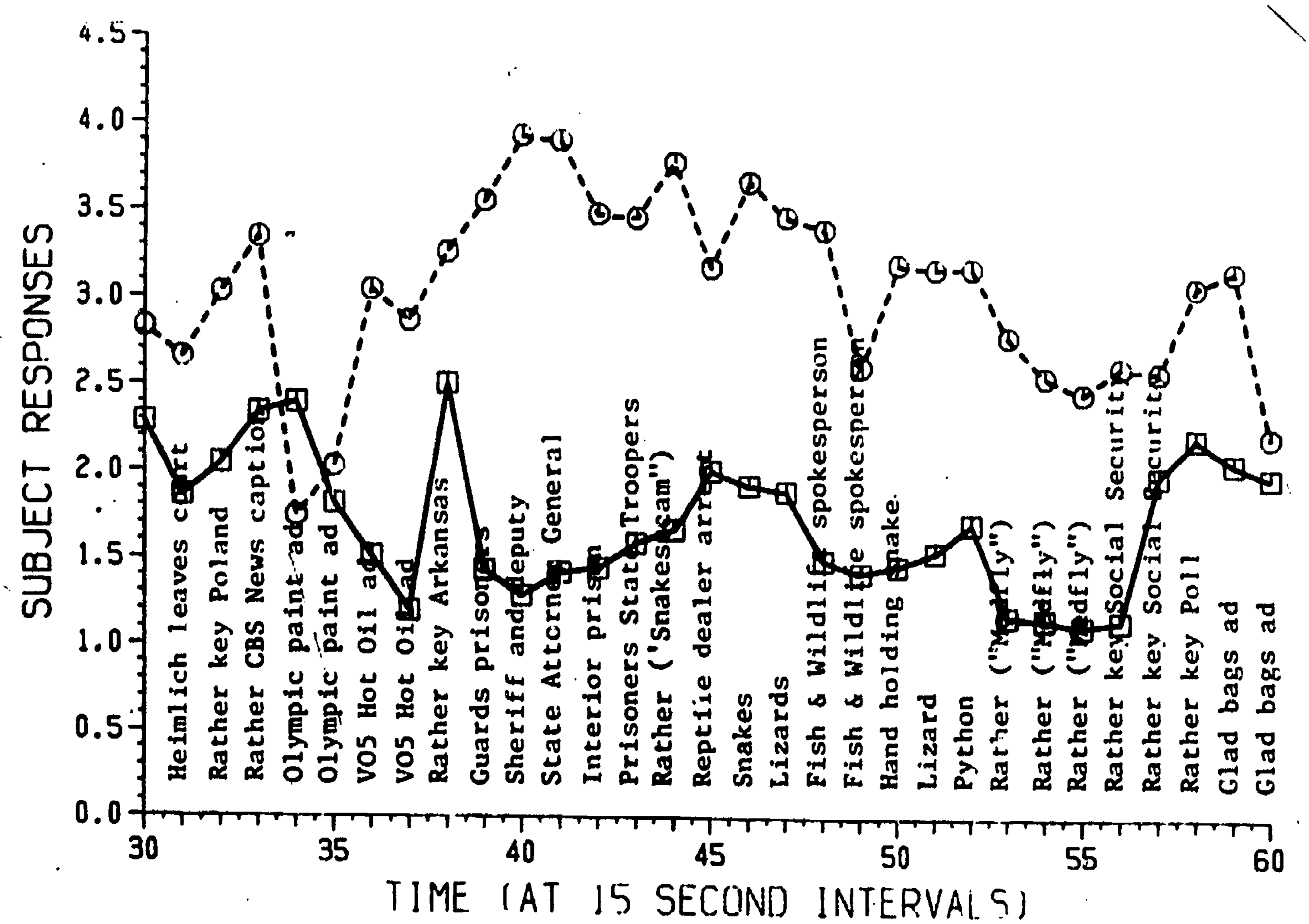



Key:

—⊞— Static complexity of frames as entropy sum (3-frame averages, reduced by K=1000)

- -◷- Subject Responses (Dynamism=Scales 3,5,6,7,8,9)

Figure 6: Subject Responses and Static Complexity Across Time (Response Intervals 1 to 30)

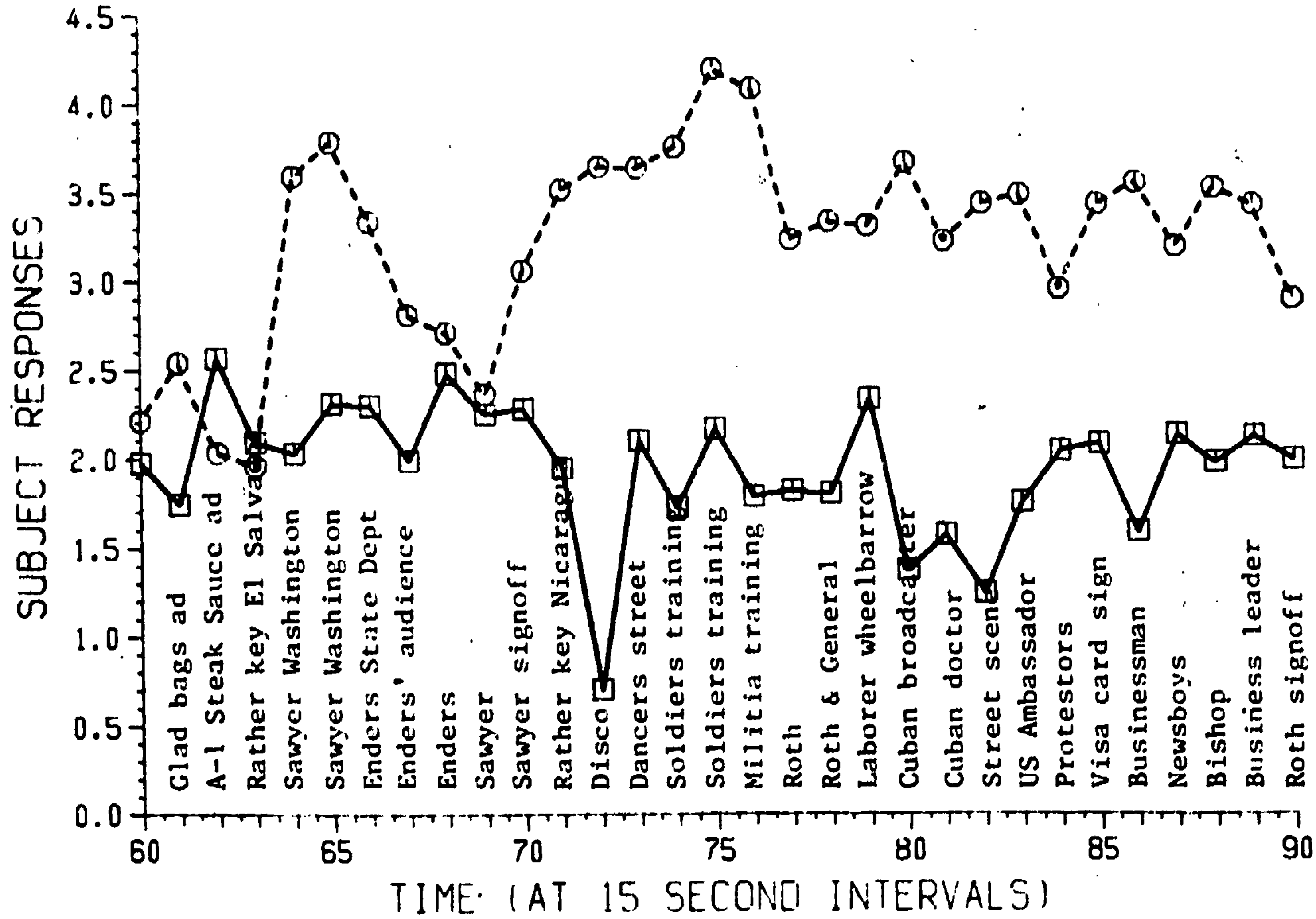



Key:

—⊞— Static complexity of frames as entropy sum (3-frame averages, reduced by K=1000)

- -⊖- Subject Responses (Dynamism=Scales 3,5,6,7,8,9)

Figure 7: Subject Responses and Static Complexity Across Time (Response Intervals 30 to 60)

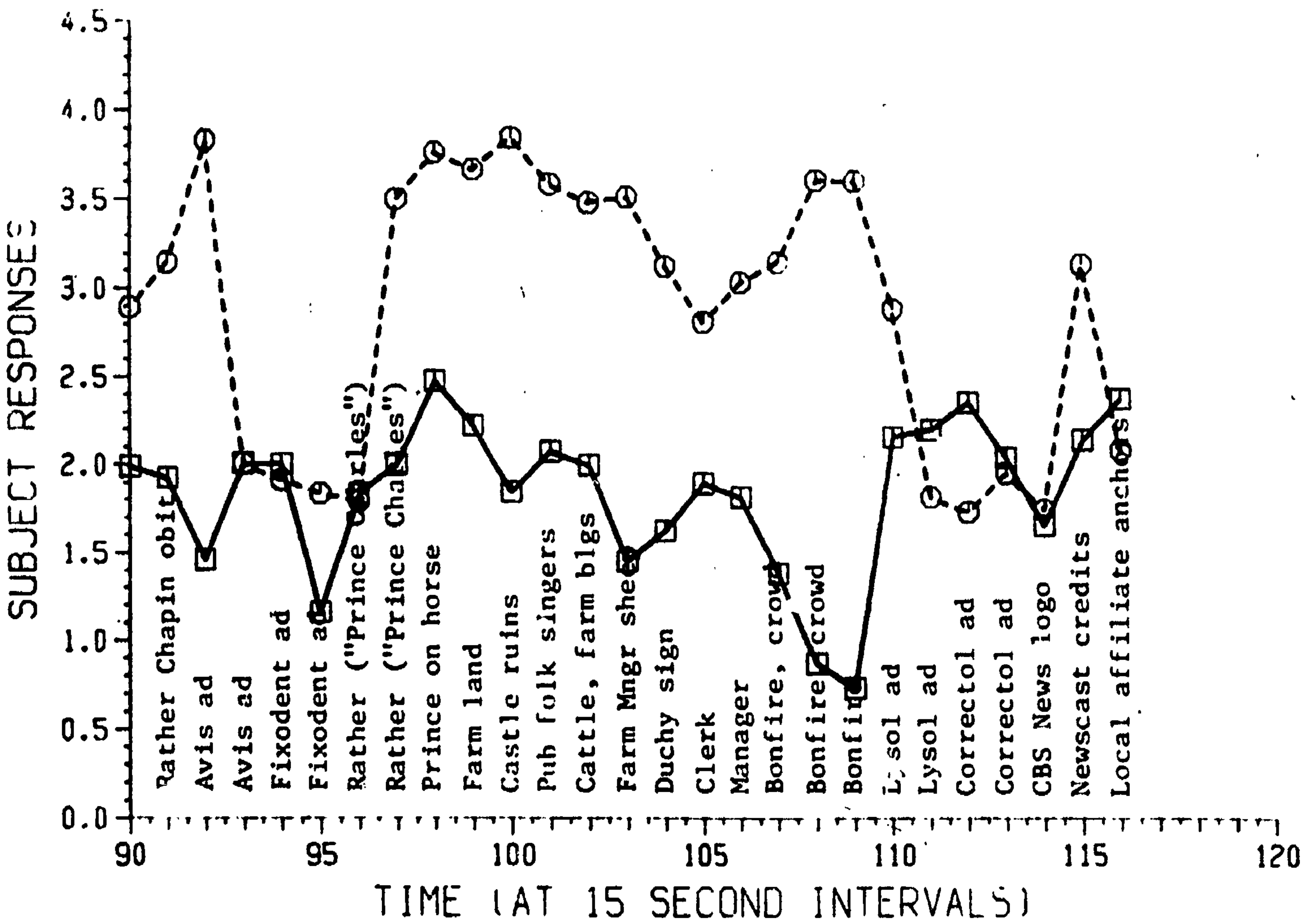



Key:

—⊞— Static Complexity of frames as entropy sum (3-frame averages, reduced by K=1000)

- ◷ - Subject Responses (Dynamism=Scales 3,5,6,7,8,9)

Figure 8: Subject Responses and Static Complexity Across Time (Response Intervals 60 to 90)

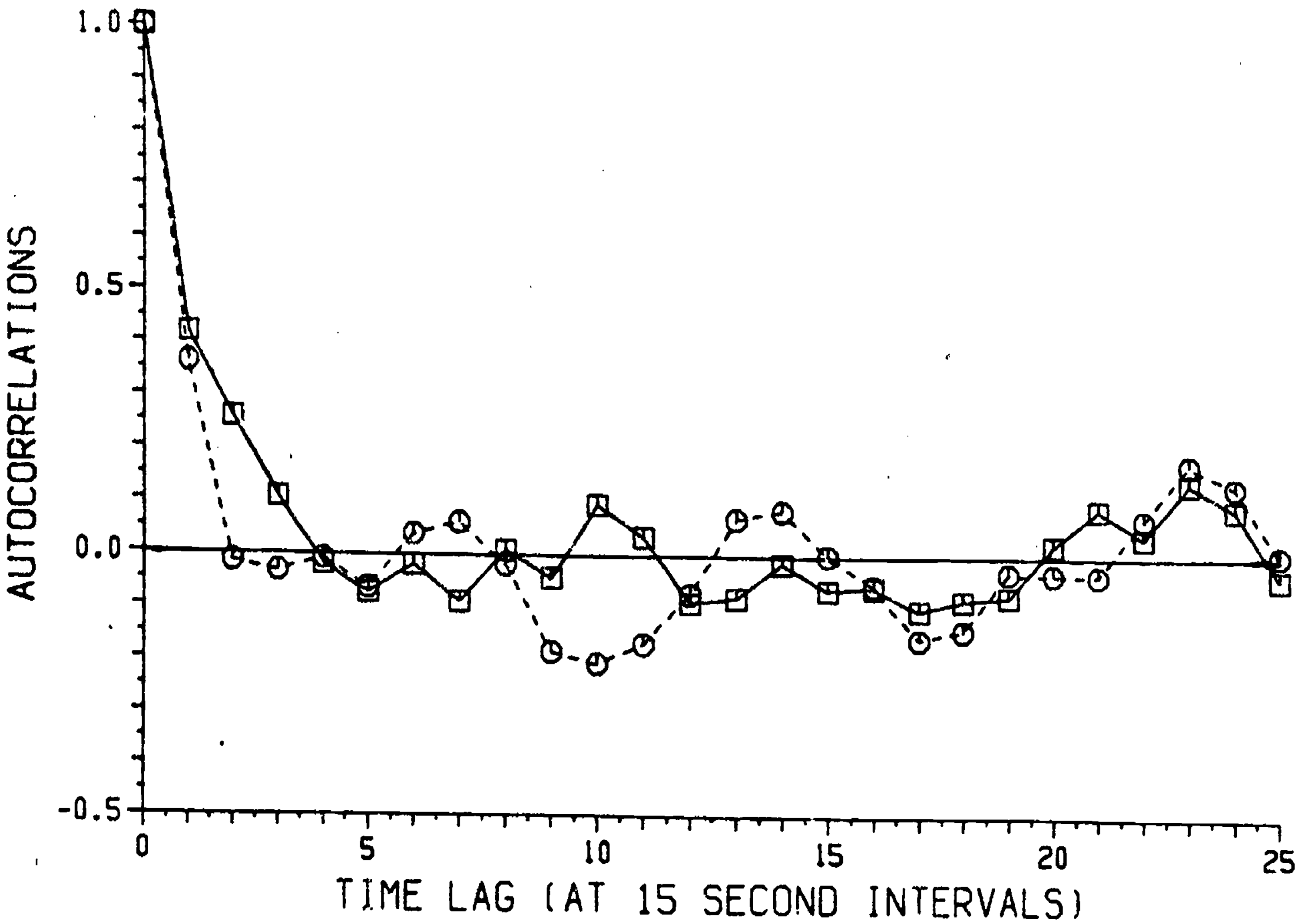



Key:

—⊟— Static Complexity of frames as entropy sum (3-frame averages, reduced by K=1000)

- -⊖- Subject Responses (Dynamism=Scales 3,5,6,7,8,9)

Figure 9: Subject Responses and Static Complexity Across Time (Response Intervals 60 to 116)




Key:

—□— Subject Responses (Dynamism=Scales 3,5,6,7,8,9)

- -○- Static Complexity of frames as entropy sum

Figure 10: Correlogram of Autocorrelations for Static Complexity and Subject Response

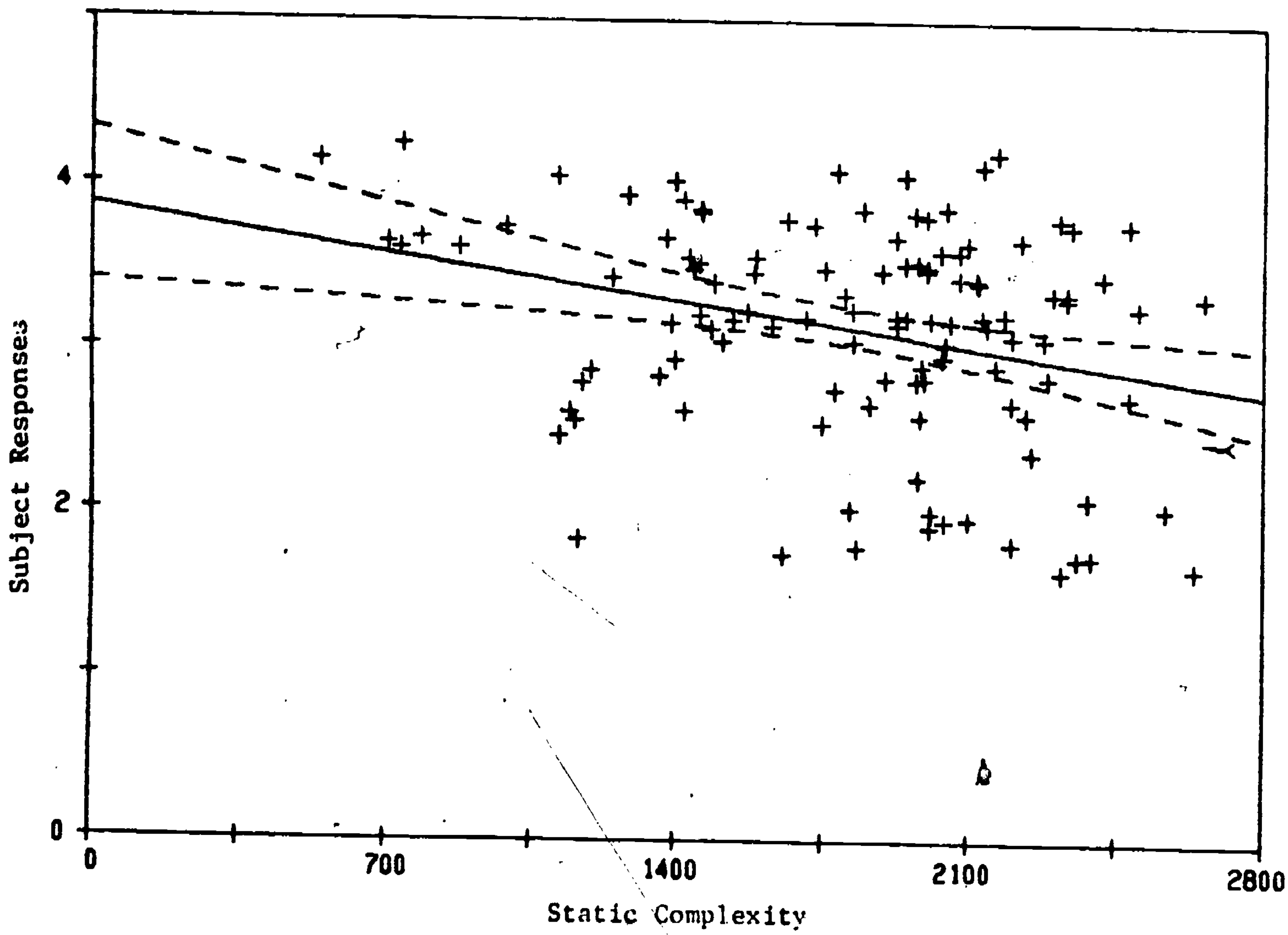



Figure 11: Scatterplot of Static Complexity and Subject Responses with Regression Line and 95 Percent Confidence Interval Fitted

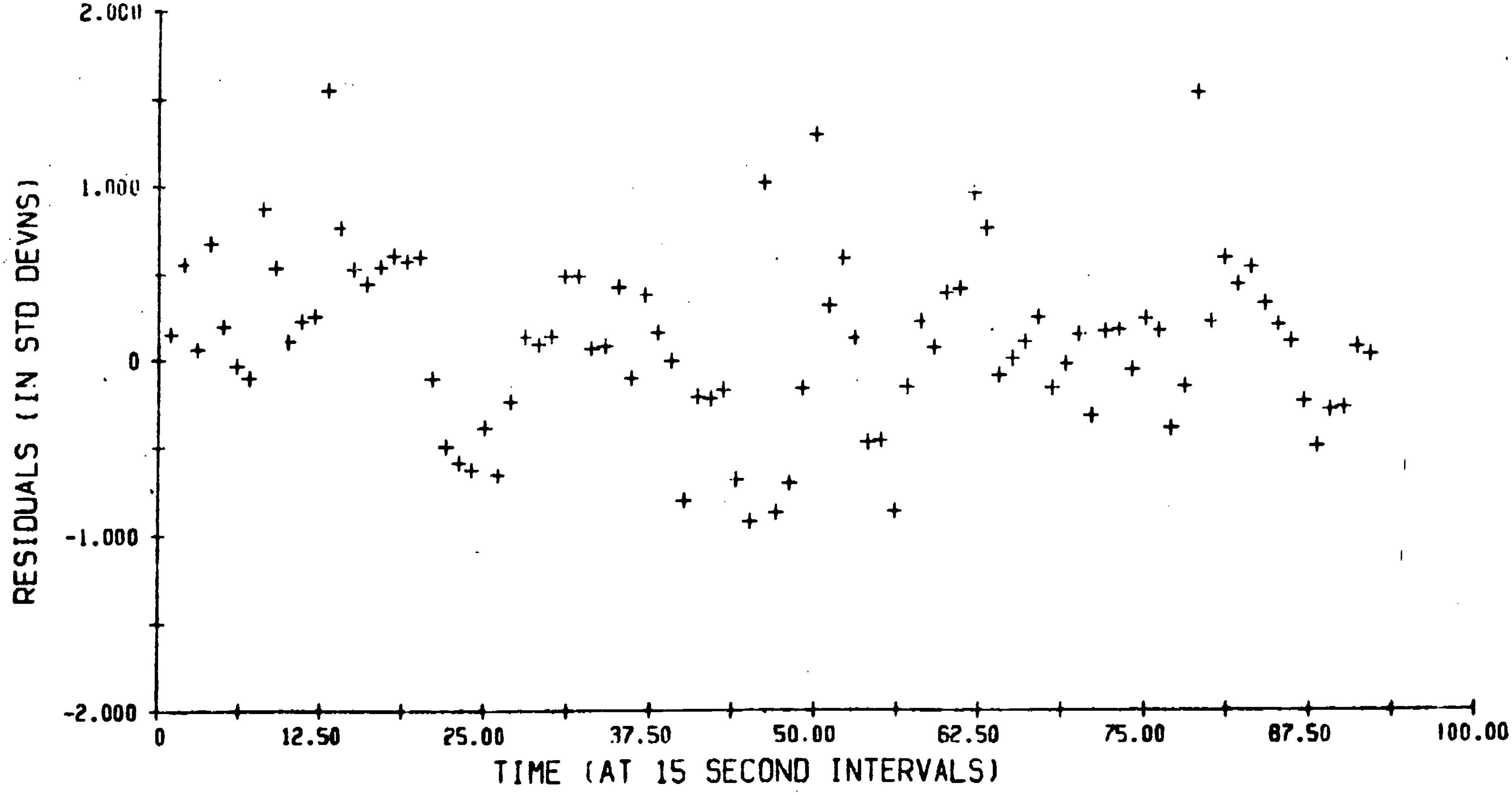
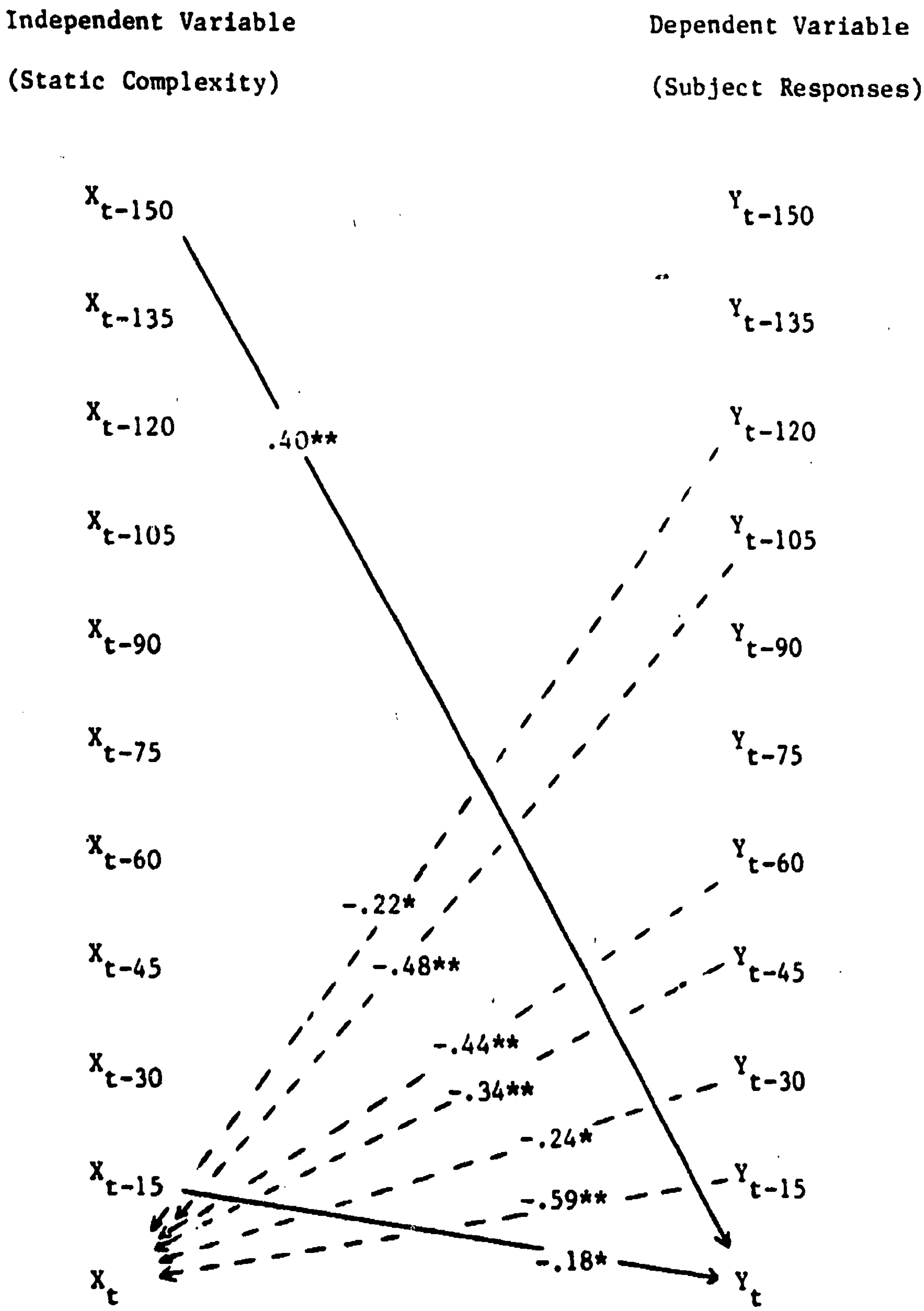



Figure 12: Plot of the Residuals from the Preliminary Transfer Function




** Standardized beta coefficient significant at $p < .01$ (df=59)
* Standardized beta coefficient significant at $p < .05$ (df=59)
t Time lag in seconds

Figure 13: Direct Granger Causality/Anticipation Model Showing Standardized Regression Coefficients of Significant Lags

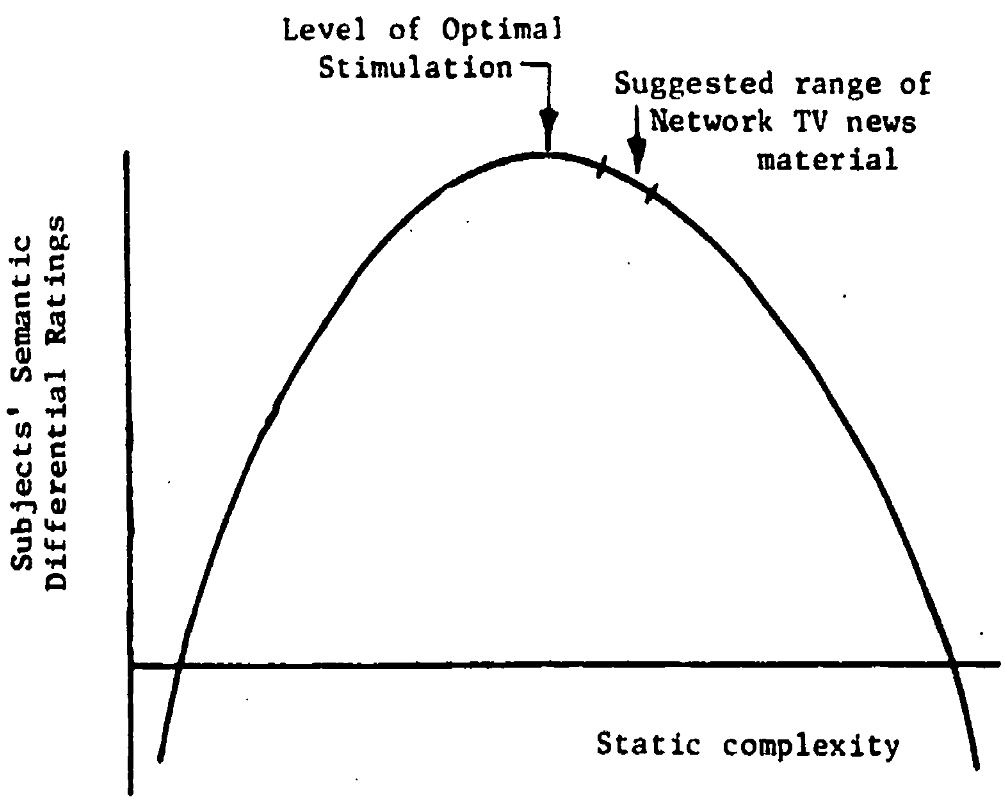



Figure 14: Hypothesized Relationship Between Subject Semantic Differential Ratings and Static Complexity Showing Possible Location on Curve of Network TV News Material