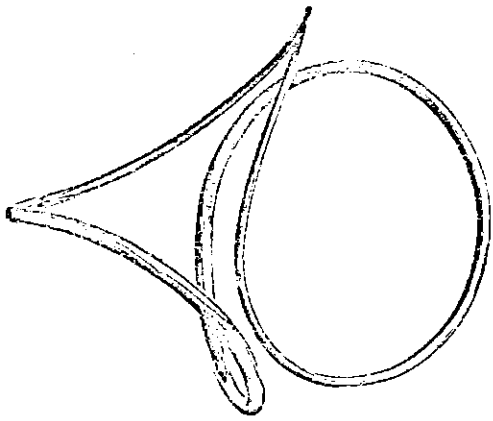




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PANEL ON: THEORIES AND DEFINITIONS

WORKING PAPER ON: MODELS OF MESSAGES: THREE PROTOTYPES

PREPARED BY: KLAUS KRIPPENDORFF, University of
Pennsylvania

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MODELS OF MESSAGES: THREE PROTOTYPES

by Klaus Krippendorff

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The Annenberg School of Communications
University of Pennsylvania, Philadelphia

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Klaus Krippendorff

ABSTRACT

This paper identifies the problem of analyses of message content as one of making specific inferences from recorded text to characteristics of a source that are not directly observable. The problem is common to a variety of analytical situations in the humanities and in the social sciences; and the way adequate solutions are found therefore deserves systematic attention.

Choices among investigative techniques always imply assumptions regarding the structure of a source. In message analysis, investigative methods crucially affect the conceivable relations between the recorded text and the content it presumably conveys to the analyst. While there is no appropriate theory of these (basically semantic) relations to which the notion of "message" refers, it seems that three classes of analytical constructs or basic models of messages account for much of current investigative efforts. This paper examines the nature and limitations of these models which are as follows:

Association models of message are identified by their use of statistical correlations as a logical basis for content inferences from text. Whether correlations are demonstrated or postulated, such models assume that content indicators permeate throughout a text, that the text is not purposively intended and that syntactic constructions and their possible referentiality can be ignored. While preferred by many content analysts, association models provide the weakest basis for content inferences.

Discourse models take linguistic references as the primary basis for inferences from text. Requisite analytical procedures are not statistical but essentially algebraical and incorporate psychological or social constructs of the semantic domain of a discourse. Discourse models are incapable of handling instrumental uses of language.

"Communication models of messages" refers to a class of analytical procedures that go beyond linguistic references and/or associations by considering the behavioral constraints that the exchange of messages may impose on a system of interacting communicators. Recorded texts then take the form of chronologies of exchanges and communication models render such chronologies informative about the parameters of an interaction system including the relations among the communicators and their mutual control. While communication models are the most interesting, least is known about them. This paper therefore elaborates only on some of their formal prerequisites.

Association models employ familiar behavioral science methods and therefore provide so serious obstacles for their possible computerization. Algorithms for discourse models presuppose a considerable theoretical work, particularly in linguistics and semantics, and it is already evident that no "general discourse analyser" can be constructed. So far attempts to computerize communication models of messages have been limited to the most reduced situations. Further, although such models are potentially most powerful very little can be expected from current computational technology.

The paper finally suggests that efforts should be directed toward formalizations of content inference processes if analytical success is to be improved.

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INTRODUCTION

In this paper I want to suggest three basic models or analytical constructs that seem to underlie many current investigative efforts regarding the content of messages. By distinguishing these models, which are by no means definite and final, I hope to sharpen a few critical problems the solution to which has been avoided by traditional content analysts, mainly because of their habit of dealing intuitively with the subject. The problem of adequate models is not only a matter of intellectual curiosity. It becomes crucial when algorithms for automated analysis are sought. Here I will not presume to give a detailed formalization of such models, nor can I treat their methodological and theoretical implications in detail, I rather want to focus on the principles that go into their construction. These models thus appear quite general and can be treated without reference to particular communication situation: as prototypes.

I admit that much of my interest in inquiries into the content of messages has been stimulated by the unpardonable misconceptions toward which naive content analysis research lends itself too easily. Space does not allow a critical review here; I have dealt with some of it elsewhere (Krippendorff, 1967). Because the goals of analytical approaches to the content of messages are so unclear, I cannot help making explicit the framework to which I want to confine myself:

The Message Analytic Situation

For my own work I have found it convenient to describe as follows the situation in which inquiries are made into message content:

(1) In the environment of an analyst there always exists a real system, a source¹, which is singled out for attention. However the boundaries of this source are defined, it has typically many interacting components between which information may be exchanged. There is virtually no logical limit to the kind of source that an analyst may be confronted with: international

systems, political organizations, the mass media, conversational exchanges within small groups, a system of linguistic references, cognitive interactions, etc. Such sources may thus be composed of neurons, linguistic items, people and their objects, social groups or nations.

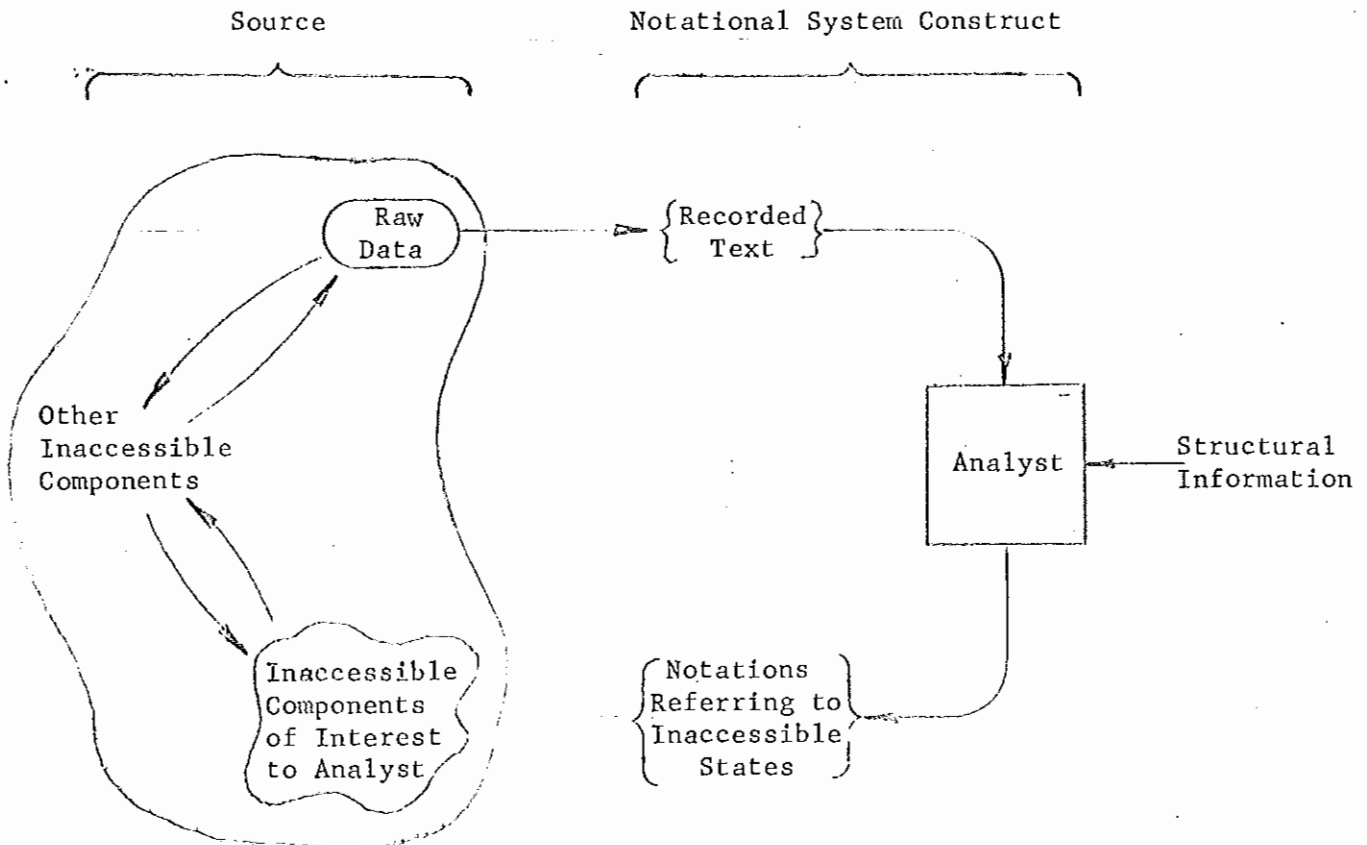


Diagram of the Message Analytic Situation

Figure 1

(2) The source is only partly observable to the analyst. Large segments of it remain in some measure inaccessible to his direct observation: Diplomatic documents represent only a small aspect of international behavior; the mass media make available only the "front" of a vast entertainment industry; psychotherapeutic interviews tap only a small fraction of a patient's personal history, and markings on stone often are the only remains of an extinct but complex civilization.

(3) Communication to the analyst is one-way only, i.e., the analyst cannot manipulate the source and if forced to study it unobtrusively. The war-time propaganda analyst can neither request information from an enemy country nor is the monitored domestic propaganda directed toward him; neither can the analyst aware of how he is being studied through the medium of his writings; and observations recorded during an experiment subsequently become detached and independent from the situation which they characterize.

(4) The analyst's problem is circumscribed by his interest in knowledge which is not directly accessible to him: Psychoanalysts may want to identify the psychopathologies of a patient; political analysts may be interested in finding out how the social revolution in China proceeds; students of communication may wish to quantitatively assess hidden gatekeeping mechanisms and psychologists may be concerned with certain latent attitudes of presidential candidates.

(5) The analyst attempts to regard available observations, the given raw data or text as messages about specific states events or phenomena of the source which he cannot observe directly. Stories obtained during a Thematic Apperception Test may be utilized to infer a subject's motivation, personality and cognitive structure; domestic propaganda may become the basis for inferring whether a secret weapon system exists; public speeches honoring a head of state may be processed to reveal the power structure within a governing elite; and research efforts may be directed toward inferring the authorship of an unsigned document from stylistic features.

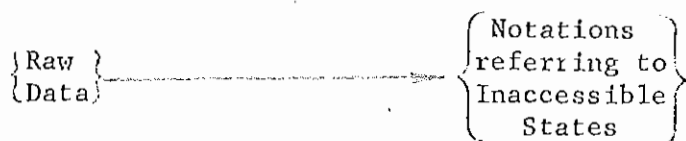
(6) Since the intended inferences refer to unobserved states of a source, a formalized language or some notations must be available to the analyst in terms of which the source is represented either in whole or as far as is demanded by the analyst's inferential problem. Psychodiagnosis presupposes a technical jargon by which psychopathologies are defined unambiguously; anthropologists who regard the remains of an ancient culture as messages

about its social structure need an adequate language in which the content of these messages may be formulated; political analysts of diplomatic documents may have to employ elaborate system constructs within which intentions, consequences, change of power structure, etc. find adequate representation. The analyst's notations may involve nothing more complex than a set of names, as is the case in problems of authorship identification; or, they may involve a complex syntax as may be required to describe the possible events within the type of sources which interest political analysts.

Within this framework dogmatic attitudes expressed in such questions as to what the content is become vacant. Messages do not exist in isolation. Their content may be inferred by someone and in reference to some clearly designated source about which it becomes informative by virtue of this effort. Any observational data can potentially obtain message characteristics for a receiver to whom it appears informative. Similarly, scientific data may become messages to an analyst if they are treated in such a way that valid information about unobserved components of a source is gained, regardless of whether data were generated for this purpose. This ability of an analyst to process data as messages about a source is of course logically prior to the ability to detect the message characteristics that a text may have for a particular receiver and, therefore, deserve special attention. It should be emphasized that contents, understood as objects referred to, ideas expressed, events described, or changes predicted, cannot be analyzed, although it may be possible to consider data informative about them through specific inferences. And by the nature of the message analytic situation, the results of such content inferences are bound to be cast in the analyst's formal notations.

The analysis of messages is then equivalent to an appropriate selection among the notations of a formalized language referring to possible states of the inaccessible components of a source (i.e. notations referring to possible

contents) as a consequence of data received. Such a realization of data as messages about a source always involves content inferences of the type:



whereby the process² depicted by the arrow must be adequate in reference to a particular source in terms of which the appropriateness of the selection or the validity of the inference may be assessed. While I wish to confine myself to only this framework for the analysis of messages; I hope at the same time to stimulate a discussion about whether this is the sole analytical framework appropriate for the analysis of message content involving data.

The Explicit Nature of the Procedure

Evidently a large number of situations can be described in terms of the above framework. Insofar as this framework provides the basis for scientific investigative techniques it is required that their component procedures and decisions be amenable to detailed methodological examination independent of the particular data processed. It is on this basis that traditional content analysis must be distinguished from an explicit processing of data as messages about unobserved phenomena.

The analytical process of traditional content analysis is well characterized by Irving Janis, who suggested that it refers

...to any technique a) for the classification of the sign-vehicles b) which relies solely upon the judgments (which, theoretically, may range from perceptual discrimination to sheer guesses) of an analyst or group of analysts as to which sign-vehicles fall into which category, c) on the basis of explicitly formulated rules, d) provided that the analyst's judgments are regarded as the reports of a scientific observer (Janis, 1965: 55).

It is important to notice that, while the formalized language of traditional content analysis consists of the explicitly formulated categories of a class-

ification scheme, the critical process of inference is never explicated and relies solely upon the intuitive judgments of an analyst.

To me there can be no doubt that much of our current concern with messages cannot bypass the judgments of qualified analysts. Their qualification may stem from their familiarity with the language, their expertise with the subject matter and from the ease with which they gain theoretical insights. But to use analysts in the way traditional content analysis has done is nothing but a way of evading the crucial problem of explicating precisely those processes that account for their ability to regard a text as a message about something.

The term "analytical procedure" can refer to only an explicated process, one that can be talked about in some detail, one that can be replicated with a minimum of intuitive judgments, or one that has the potential of leading to a computer program for automatic analysis. I would therefore like to limit my concern to the making of explicit content inferences. I presuppose that data are recorded in textual form, and I wish to consider a text as exhibiting its structure just on the basis of the distinguishability and identifiability of its constituent elements.

The term message analysis may therefore be restricted to any scientific method for making specific content inferences from recorded text³

With this definition I wish to rule out from my concern all traditional content analysis insofar as the central process of making content inferences relies on an analyst's intuition and explicit techniques are merely used as aids to identifying, sorting or counting occurrences in a text⁴.

The Information Requirements

With this confinement to explicit processes I avoid discussing two out of three sources of inadequacy which affect the success of an analysis negatively. Let me mention them briefly.

The most obvious prerequisite for analytical success is that the recorded text

accurately represent relevant observations. To achieve what I will call "observational adequacy" is not at all an easy matter. What is relevant for a particular analysis depends not only on the problem chosen by the analyst but also by and large on his knowledge about the structure of the source under consideration. What is recorded is often neither relevant nor significant, and what is relevant and significant in the light of systematic theory is often difficult to transcribe.⁵ Since the level of knowledge about the source may change during the course of an analysis, the relevance is not always determinable a priori.

Another prerequisite which is equally important but more difficult to assess is referential unambiguity of notations chosen to represent content. I like to refer to this aspect of analytical success by the term "representational adequacy." Not only is the relevance of such notations dependent on the changing level of knowledge about the source, but since content is not directly observable, the notations refer quite often to hypothetical constructs or conceptual variables the representational ambiguity of which can be assessed only indirectly (construct validity).

It is possible to satisfy the requirements of observational and representational adequacy without making correct content inferences. There remains therefore a third prerequisite for analytical success. This will be called "procedural adequacy," and refers to the appropriateness of the inferential process in reference to the source under consideration.

Without intending to go too deeply into the argument, I think traditional content analysis has been too much concerned with observational adequacy to the exclusion of the others. The emphasis on category schemes in which verbal data can be recorded easily, the quest for reliability without control for validity as well, the voluminous and aimless counting exercises all point to negligence concerning problems of representational, and particularly procedural, adequacy. In 1952, Harold Lasswell observed that:

...there is as yet no good theory of symbolic communication by which to predict how given values, attitudes, or ideologies will be expressed in manifest symbols. The extant theories tend to deal with values, attitudes, and ideologies as the ultimate units, not with the symbolic atoms of which they are composed. There is almost no theory of language which predicts the specific words one will emit in the course of expressing the content of this thought. Theories in philosophy or in the sociology of knowledge sometimes enable us to predict ideas that will be expressed by persons with certain other ideas or social characteristics. But little thought has been given to predicting the specific words in which these ideas will be cloaked. The content analyst, therefore, does not know what to expect (15:49).

Procedural adequacy of a message analytic process can be assessed in terms of the appropriateness of the selection among available content representations in the light of evidence about the inaccessible states to which the notations refer. Ross Ashby has shown that the making of appropriate selections is intrinsically related to the quantity of information available to the analyst (Ashby, 1960). Indeed, many of the analytical problems with which the analyst is faced can be regarded as problems of making effective use of sparse information about the source he is dealing with. The analyst requires a certain amount of structural information in order to make procedurally adequate content inferences about a source.

Given that the distinctive characteristic of messages is their informativeness about unobserved components of a source, and given that the treatment of a text as message presupposes that the analyst has available information about the structure of that source, we can ask four important questions:

- (1) What is the structure of the information that enables an analyst to make content inferences about a source?
- (2) How can the needed information be acquired, and what are the criteria for assessing the validity of this information?
- (3) How can given information be operationalized, e.g. how can structural information be represented in algorithmic form?
- (4) What evidence establishes the validity or the success of the message analytical process as a whole?

Clearly, the answer to (1) is required prior to serious considerations of all other questions. I therefore limit myself to a discussion of just this question.

Models of Messages

Questions regarding the structure of the information that enables an analyst to process messages are in effect questions of semantics. Since the term has acquired so many different shades of meaning, I want to avoid it here. But these questions can also be regarded, and perhaps more fruitfully so, as being answerable in terms of partial theories about the source as a system of interrelated entities, particularly theories that are predictive in both the dimensions within which observations are recorded and the ones within which information is of interest to the analyst. Since I am not concerned with particular partial theories that render contents for given texts, but rather with the basic structure of such theories, I refer to them by the term "models of message." This term then is meant to denote structures of analytical constructs which the analyst may employ when regarding a given text as a message about some feature of a source.

In the literature on attempts to treat texts as messages in the above sense, essentially three models seem to account for most of the content inferential efforts. Each regards messages differently. Each has its own merits and limitations. I will call these models:

- (1) Association models of messages, which realize contents in statistical correlations between observational variables.
- (2) Discourse models of messages, which consider contents as linguistic referents and realize it in denotations and connotations.
- (3) Communication models of messages, according to which contents become manifest in processes of control within dynamic systems of interaction.

ASSOCIATION MODELS

The General Nature of such Models

The conceptually simplest model for characterizing the message characteristics of a text is based on the idea of statistical association. It assumes that a source can be depicted adequately within a finite number of dimensions that are logically or observationally distinct for the analyst, but statistically related as far as the source's manifest properties are concerned. Just as the members of a population may be characterized by a particular set of attributes, so are the possible states of a source depicted as consisting of a finite number of components.

Informativeness within association models of messages is consequently assessed by statistical measures of correlation. When the correlation between two sets of dimensions is high then, in general, an observation on one set of dimensions yields information about the other set and can hence be considered a message about those other dimensions. The recognition of the message characteristics of some text presupposes that the analyst has knowledge about the multi-variate probability distribution of possible events which include the text as components. One extremely simple and by now classical example of the use of association models for making inferences from text is John Dollard and Hobart Mowrer's study of the Discomfort Relief Quotient (Dollard and Mowrer, 1947). This quotient is computed from the frequencies with which two classes of words occur within recorded speech and was found to be indicative of a speaker's state of stress on the ground that the extent of stress as observed and the value of the quotient correlated significantly. George Mahl and Gene Schulze (1964) reviewed this research tradition recently and showed that a host of measures such as speech-disturbance ratios, verb-adjective ratios, and speech rates do have some diagnostic value to psychologists interested in information about a speaker's concurrent emotional states or his psychopathologies.

Association models of messages are by no means confined to psychological

endeavours. The classical problem of identifying the author of unsigned documents can employ identical conceptions. Such a problem may be solved when stylistic indices can be found that vary little within and as much as possible across the works of suspected authors. Whether such stylistic indices are computed on the basis of the authors' vocabulary (Yule, 1944), on certain function words (Mosteller and Wallace, 1964), or on other minor encoding habits (Paisley, 1964), their informativeness is rendered by demonstrating statistical associations.

In mass media research, association models are even more prominent. For example, measures of the diversity of political symbols occurring in the major newspapers of a country have been shown to be indicative of socio-economic crises and feelings of uncertainty (Pool, 1962); journalistic assessments of sensationalism lead to measures that correlate highly with intuitive judgments regarding this concept (Tannenbaum and Lynch, 1960); similarly have attempts to infer the readability of a text resulted in the proposal of a set of indices (Flesch, 1951). In most studies, unfortunately, the statistical associations needed are assumed and rarely tested for their significance. The basic assumption of much of traditional content analysis has been that the relative frequency with which a certain reference is made within a text correlates with the attention or importance assigned by a writer to the object referred to.

The content inferences that association models of messages can account for involves:

- (a) A set of elements (recording units) that are regarded as constituents of the text without consideration of their sequential order within the text.
- (b) One or more measurements, $m_i(\text{text})$, that are made on selected elements of the text. The measuring operation is a mapping

Text $\xrightarrow{\quad\quad\quad}$ $m_i(\text{text})$.

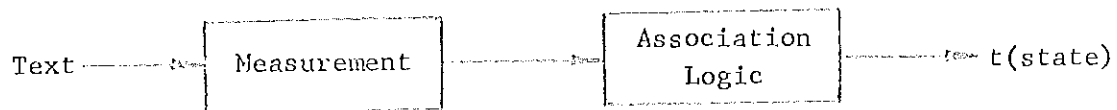
- (c) A set of operationally defined terms, $t(\text{state})$, or a variable that represents extratextual (momentarily unobserved) states of the source.

- (d) rules of content inference that define a probability distribution, P_m , over the set $\{t(\text{state})\}$ of terms or of possible content representations which is conditional on the set $\{m_1(\text{text}), m_2(\text{text}), \dots\}$ of measurements,

$$\{m_1(\text{text}), m_2(\text{text}), \dots\} \longrightarrow P_m(t(\text{state})) .$$

It should be noted that the conditional probability, P_m , is a frequency interpretation of probability and the rules of content inferences are not mappings. A text can be said to be informative about unobserved states of a source if the probability distribution significantly deviates from chance.⁶

Association models of messages thus require two procedural components, a measurement component and what I like to call an association logic; the latter accounts for the content inferences. This may be depicted in Figure 2.



Procedures of Association Models

Figure 2

More or less hidden, association models appear in a variety of essentially different research designs. Naturally, commitments to this prototype are most explicit in experimental approaches. For example, attempting to show the validity of his contingency analysis, Charles Osgood (1959) set up a situation in which word association structures could be measured by a standard association test and correlated with the results of a contingency analysis of the subjects' verbalizations.

Trying to find an objective procedure for distinguishing real from simulated suicide notes, Philip Stone and associates were aided by a computer program that enumerated the occurrence of specified classes of words within a text. After inspection of the frequency tabulations a decision criterion was developed. The above-chance frequency of success subsequently established its informativeness (Stone and Hunt, 1963).

Earl Hunt's Concept Learner, on the other hand, is a computer program that discovers inferential information automatically. Given two texts that are differentiated according to an outside criterion, (for example, being for or against a legislative proposal), the Concept Learner develops a discriminate function (involving as many measures as necessary) that accounts for this differentiation. This discriminate function, which in fact takes the form of a decision tree, can subsequently be used to render a third text informative about the outside criterion, for example, whether it supports or rejects the proposal (Hunt, Marin and Stone, 1966: 159).

Powers and Limitations

Researchers assuming association models for their inferences are bound to believe that the informativeness of a text about a source's states increases with the number of different measurements that are considered. This belief is due to the nature of multivariate techniques which suggest that the predictability of a phenomenon can only increase with the number of variables observed?

That an increase in the number of measurements does not guarantee an approximation of adequate inferential procedures was the lesson of a gigantic yet unpublished study designed by the Institute for Communications Research at the University of Illinois. The investigators took as many as 70 written passages of about 300 words each from such varied sources as The Bible, The Chicago Sun-Times and a manual for operating a Remington typewriter. Each of these passages was analyzed in 55 different ways. The 55 different analyses

had been suggested in the content analysis literature and claimed to measure some effects a text may have on its reader, e.g., retention, interest, willingness to read more material of a similar nature. The analyses involved simple counts such as the number of first, second and third person pronouns, various indices such as readability scores; the average number of meanings per word; and scaled judgments such as interestingness of subject matter, how well written. In total, the study was a gigantic design, "a content analysis to end all content analyses."

A factor analysis revealed 10 factors accounting for some 62% of the total variance. But most of the factors could not be interpreted in a meaningful way. If valid, it was argued, the factors should at least be able to distinguish among texts of different sources. Positive results were only slight.

Then a set of texts scoring high, medium, and low on form factors believed to be meaningful were given to readers who were subsequently subjected to a series of tests known to measure interest, evaluation, comprehension and retention of content. Correlation of the test results with each of the factors yielded no satisfactory results, whereupon work on the text variables was suspended (Suci and Husek, 1957). It is unfortunate that important studies are rarely published when results are negative.

No doubt that the research had been designed and executed with all necessary care. It seems however, that association models are procedurally inadequate for the kind of system under scrutiny. A source that embodies processes of understanding a text linguistically and exhibits active interest in novel assertions may require models of messages that are more powerful than association models.

Let me point to four basic limitations of association models that cannot be overcome by any increase in the number of measurements made over a text.

First, association models treat the system under consideration as ergodic sources. This is due to the aggregate nature of statistical indices which are

computed over the occurrences of specified units within a text. Discontinuities in the frequencies of word use, verbal clarification of meanings and their consequences must escape the analysis when words or phrases are enumerated without regard to their position within a text. Unique occurrences, on the other hand, do not significantly contribute to correlations sought and although they may be informative according to some other model of messages, they disappear in this prototype. The use of the association model presupposes the assumption that the enumerated characteristics permeate the given text statistically.

Second, association models preclude considerations of reference meanings. So far, no statistically significant correlation has been shown to exist between the types of objects in a speaker's or writer's environment and the type of words he chooses to use. For example, the frequent use of the term "peace" in a text neither indicates whether the writer finds himself in such a state nor whether he desires it. It does not even indicate whether he has ever experienced such a state or whether he knows what it means connotatively or denotatively. Unless experimental situations impose serious constraints on verbal responses, inferences as to what a text refers to become vacuous on the basis of association models. While undoubtedly rendering given data informative in some sense, the prototype has very little to do with denotations and connotations. This fact cannot be emphasized strongly enough since much use of language is understood as being representational.

Third, association models are incapable of making inferences about syntactically expressed contents. That is to say, while co-occurrence and transition probabilities can be used to construct a kind of primitive grammar, association models are not powerful enough to consider sentential grammars. Among the most outstanding facts of language is that the number of sentences that a given language admits is practically unlimited and that each sentence is essentially a novel sentence.⁸ A statistical treatment of sentences becomes meaningless, however, when

repetitive occurrences are rare. Attempts to force syntactically complex linguistic expressions into a finite non-recursive enumeration scheme - just to obtain some frequencies above one - discards much of the communicative capability of verbalizations.

Fourth, association models are inadequate when a source exhibits some intelligence and exercises some control over its products, i.e., when the text is generated to satisfy a source's varying objectives. This inadequacy was first realized by George Mahl who was puzzled by the difficulty of inferring the emotional states of a speaker when linguistic assertions are used instrumentally. He argued, with association models in mind, that:

(o)ur culture places a premium on the concealment of many drives and affects, and at the same time our language training and communication habits emphasize the importance of lexical content. Since affects cannot be abolished by the censorship of their expression, and since the non-lexical attributes are not the central targets of cultural or personal control, it is to be expected that the nonlexical features are theoretically potential targets for consistent rewards and punishments (and may thus) acquire instrumental functions.... To the extent that this is so, the value of the nonlexical attributes for the content analysis will decrease. In general, it would seem to be most advantageous for the content analyst interested in drives, motives, etc., to select those nonlexical attributes that are not likely to have been influenced consistently by rewards and punishments in the past. The nonlexical attributes meeting this criterion are those that are most likely to be most remote from awareness in both the speaker and the listener (Mahl, 1959: 101-103).

Although Mahl's argument refers to content inferences of emotional states only, it focuses on a general inability of association models. Bill Paisley's phrase "minor encoding habits" points in the same direction by suggesting that stylistic indices may reveal the identity of an author only as long as he is unable to control their variation (Paisely, 1964). Likewise is the identification of psychopathologies conditional upon the inability of patients to manipulate the symptoms to his advantage.

This limitation may be turned into an analytical advantage when correlations are found of which the source is essentially unaware. But, association models have very little to do with how language is normally used and what speakers of a language express in its terms.

DISCOURSE MODELS

The Domain of such Models

I argued that association models of messages are inadequate when there is reason to believe that the message characteristics of a given text are language-like, when a text can be assumed to refer to, rather than correlate with unobserved states of a source, and when message contents are in some significant sense novel as is most typically the case in human communication. Now I will argue for a more powerful model - one which treats messages as discourse. First, some features of discourse as I see them:

(1) Typical discourses such as a political speech, a set of private letters, a monograph, a news report, a fairy tale or a scholarly treatise can essentially be considered as describing extralinguistic phenomena, as talking about events or representing ideas that can potentially be found within a source. I.e., some words occurring in the discourse are names and refer to, denote, or connote non-linguistic objects or concepts. Some sentences are statements about observed or fictional events and descriptions typically require more than one sentence.

(2) Such discourses may be thought of as generating their own parameters, delineating relevant issues and defining the meanings of terms in which unobserved phenomena are represented. Insofar as this is the case, sentences of a discourse may not be taken in isolation.

(3) Such discourses are either the product of one person or composed in such a way that it is essentially free of inconsistencies or contradiction within that discourse and in reference to the source. That is not to say that an analyst may not discover logical gaps or fallacies in the arguments but that the discourse may be said to be consistent with the speaker's or writer's point of view, ideological orientation or ideosyncratic logic.

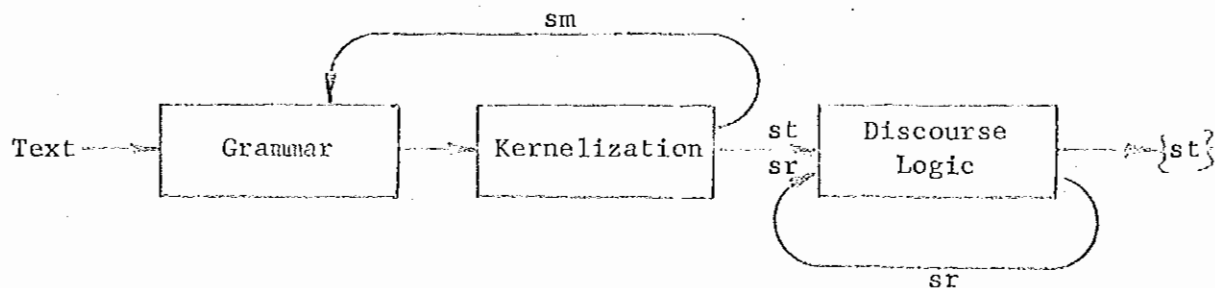
The aim of discourse models of messages then is to account for a reader's ability to understand what a discourse is about, more specifically, his ability

to respond to questions about the source that are pertinent to the analyst and can be answered from a linguistic interpretation of the text. This ability requires an adequate symbolic manipulation of what a text implicitly or explicitly describes, and involves both the paraphrasing of such information in the analyst's unambiguous notations and the inferring from this information whatever the analyst wants to know about the source.

Since I now consider both the formal terms referring to the possible contents of interest to the analyst, and the given text, to be representational, in order to avoid confusion, I should mention two extreme cases of content inferences. The simplest situation is one in which the text is already cast in the analyst's terms, thus making paraphrasing superfluous and reducing inferences to logical implications? However, the most difficult situation arises when the given text takes the form of a language foreign to the one in terms of which the analyst wishes to represent his results. Discourse models will then have to account for a translation in which the relevant referential content of the discourse remains invariant and irrelevant representations are suppressed in the course of the process.

Happily, practical situations of message analysis are more likely to be concerned with a text that is recorded in a form closely related to the analyst's output language, (English for example), and the major task of discourse models becomes merely one of extracting relevant information from a text and of making content inferences from such information.

Unlike association models, discourse models involve the consideration of linguistic meanings. In this respect the goal of discourse models overlaps with the aims of linguistic theory but will have to go beyond it, as I will show. Discourse models must consist of at least three components which I would like to call grammar, kernelization, and discourse logic. How these components are procedurally related may be seen in Figure 3 which includes abbreviations that will become clear later. Let me outline some of the respective features of these components:



Procedures of Discourse Models

Figure 3

The Grammar Component

According to the transformational school of thought, the aim of a linguistic theory of language is to find adequate representations for the structural information speakers employ in analyzing and generating verbalizations. The confinement to structural information about a language is crucial for linguists because the information that a language may represent knows virtually no limitation.

Jerry Fodor et al. conceive of the grammar of a language that represents a native's linguistic ability as having three parts - a syntax, a semantics, and a phonology (Fodor, Jenkins and Saporta, 1967). When text is written the phonological part becomes superfluous. The syntactic part is thought of as a device that either generates a set of representations of all and only the well-formed sentences of a language or assigns to each sentence proper a set of descriptions accounting for the possible ways the sentence could have been generated by that device. Jerold Katz and Jerry Fodor conceptualize the semantics of a language as consisting of a lexical dictionary and projection rules. The lexical dictionary provides an entry for each lexical item in a sentence and lists its possible meanings or senses, relevant semantic dimensions and their use. And the projection rules provide the basis for amalgamating syntactic descriptions and meanings to obtain the possible semantic descriptions or readings of a sentence (Katz and Fodor, 1964). Accordingly, the function of the grammar of a language is to determine the number and kind of readings

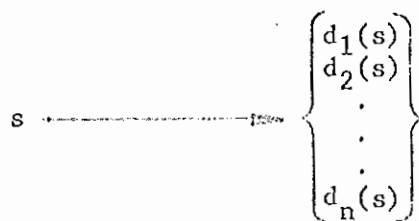
a native speaker would give to each sentence. For example the sentence:

Time flies like an arrow

may be found to be syntactically normal and to have three semantic readings:

(1) there is a species called "time flies" that prefers arrows; (2) a request is made to time the flies as quickly as possible; (3) time moves very swiftly. (It should be noted that the paraphrased content which I used to exhibit the different readings is not a product of a grammar which would indicate only that "time flies", for example, is a legitimate noun phrase in English).

A grammar is thus considered as accounting for the process that can be depicted as follows:



where $d(s)$ is a semantic interpretation of the sentence s of a text. At this stage of linguistic theory, such grammars are still quite complex and not at all perfect. But their function within a discourse model becomes clear if one keeps in mind (1) that information about the physical or social environment of a speaker is not incorporated in a grammar, and (2) that meanings are not considered above the sentence level. Consequently, the lexical dictionary characterizes the use of linguistic items intralinguistically, i.e. it lists meanings or intentional semantic interpretations, and not the possible referents of those items. The projection rules select among those meanings to satisfy the particular sentential contexts within which the item occurred. Since there are numerous words that have meaning but no referent, e.g., "maybe," "or," "hello," "ether," but the converse does not exist, a consideration of intralinguistic uses of linguistic items precedes that of their possible references. Likewise, semantic

descriptions of sentences clearly precede characterizations of their contents.¹⁰

The Discourse Logic Component

Since the aim of message analysis is to obtain information from given text about some unobserved part of a source of interest to the analyst, grammar alone will not suffice. The extensionality of its output is uncertain. What discourse models have to account for is a reader's ability to understand the sentences of a discourse referentially. One test of this ability would involve pointing to the objects to which a text may refer. Since this is impossible by virtue of the message analytic situation, the only other test is that the reader be able to draw inferences from the text which are both valid in reference to the source and relevant regarding the analyst's problem. To accomplish such inferences it seems necessary that the speaker have in addition to his familiarity with the language some basic knowledge about the subject matter of the discourse, i.e., he must employ extralinguistic information.

Understanding the referential content of sentences may become manifest in a speaker's ability to infer, for example, from the two sentences:

Mark Twain is the author of Huckleberry Finn.
Samuel Clemens lived in Hannibal

that the author of Huckleberry Finn lived in Hannibal, which presupposes information about the identity of references. The information that justifies the inference from:

Robert has a driver's license.

that Robert is above 16 years of age (depending on the state), not blind, knows how to drive a car, can identify traffic signs, etc., represents knowledge about a set of properties that are antecedent to the one referred to in the sentence.

From:

Jim saw his son Bill
Mary and Jim are married
Sam's mother Mary smokes.

it is not difficult to infer that Bill and Sam are brothers, provided that some information about kinship relations is available. Similarly, even the obvious inference from "A is larger than B, B is larger than C" to "A is larger than C" presupposes information about the transitivity of the relation "is larger than." On the other hand, the relation "is father of" has quite different properties which must be known in order to make content inferences that are adequate in reference to the source under consideration.

These examples show that the information that must be supplied by the reader in order to demonstrate his ability to understand the sentences of a discourse represent structural features of the source patterns or functions that may hold for classes of the source's states. The component that accounts for a reader's ability to make adequate inferences from given sentences may be called "discourse logic." It can be considered the most distinctive feature of discourse models of messages. The discourse logic component suggests that a distinction be drawn between two kinds of sentences

- (a) State descriptions, "st," or sentences that refer to particular states of the source and
- (b) Structure descriptions, "sr," or sentences that refer to relations among states or classes of states of the source.
- (c) The rules of content inference that are permissible within a discourse logic are then of the deductive type, e.g.

$$(st_i, st_j, \dots, sr_{ijk}) \longrightarrow st_k$$

The discourse logic of such models thus produces new state descriptions that are logically implied by the text. Whether the required structure descriptions

are exclusively extracted from the text or whether they are incorporated into the analytical process prior to the analysis, the adequacy of the inferences made is uniquely determined by them. A discourse logic evidently presupposes that the text is kernelized and of such a canonical form that the collection of descriptions represents the relevant content of the text as a whole. How this may be accomplished is suggested below.

The Kernelization Component

Discourse logic essentially requires a set of statements in a canonical form, i.e., each state description or structure description must be of such a form that it can be taken out of context and be used as a basis of discourse logical inferences. A grammar, on the other hand, provides semantic characterizations for each sentence the content of which is in some significant way dependent on context. The input of the kernelization component can therefore be considered a string of concatenated sets of semantic descriptions for each sentence occurring in the text. Its major aim becomes one of breaking a semantically interpreted text into context independent units and of transforming these units into the canonical form of state or structure descriptions. Let me be more specific about this aim.

First, one of the important features of discourses, with implications for the construction of a grammar, is their ability explicitly to define or implicitly to modify the meanings of terms occurring in the very same discourse. Such definitions or modifications may affect subsequent readings of a sentence in a way not normally considered when interpreted out of context. I cannot fully agree with Katz and Fodor when they assume that a grammar provides a set of alternative semantic interpretations of a sentence among which a speaker may merely select on the basis of his knowledge about the physical setting in which the sentence was uttered. At least as far as the expression of referential content is concerned, language is a very flexible device. Although it is easy to imagine

a story, let us say, in which the sentence:

Careless little dogs sleep quietly

is informative about some state of affairs, it is not at all impossible to find or construct a discourse within which the grammatically normal sentence:

Colorless green ideas sleep furiously

becomes not only meaningful¹¹ but has content as well. The grammar that Katz and Fodor suggest would be insensitive to linguistic environments which may specify the meanings of such a sentence's components and would not assign any semantic description to the latter sentence. It is only when such sentences are taken without their linguistic environments that they appear semantically odd. Almost every discourse can contain such sentences as

By "X" is meant "such and such,"
I want "X" to refer to such and such, or
"X" is defined as "such and such."

Sentences of this sort refer not to extralinguistic events but to the use of the linguistic item "X" within a discourse and establish a semantic convention. Let me refer to such sentences as meaning descriptions, "sm." Meaning descriptions often do take up large portions of political, private and scholarly discourses and effectively override established meanings.

What I am therefore advocating is an adaptive lexical dictionary, in which meaning descriptions can be incorporated after proper translation into respective canonical forms.

Second, much of normal discourse relies heavily on implicit rules for the use of otherwise semantically indefinite linguistic items. For example, pronominal forms are almost always used and perceived as having definite references that are understood in the context of other sentences. If statements are

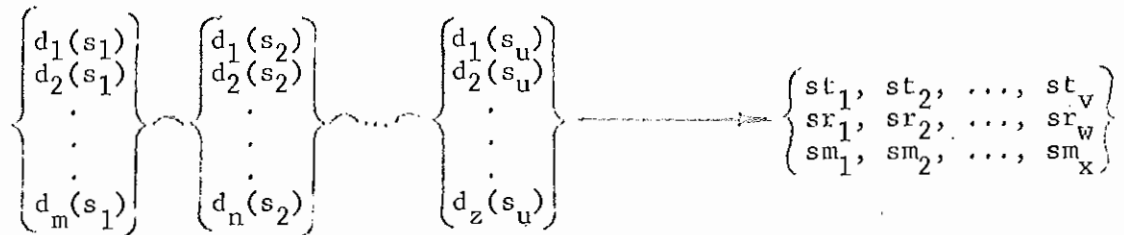
to be taken as elements in a set without loss of their contents, i.e., if their semantic interpretations involving pronouns are isolated from their immediate linguistic environment, then pronouns have to be replaced by the nouns in the place of which they stand. Similarly, when a time sequence of events is implicitly referred to by the sequential order of their linguistic representations, a kernelization that loses those references may yield unwarranted inferences. Thus, although a language surely does not provide grammatical constructs above the sentence level, as Katz and Fodor correctly recognize, speakers do tend to use rather efficient referential constructs to disambiguate grammatically indefinite references. Rules based on such constructs clearly involve information outside the boundary of a sentence. The explication of such rules may be difficult, but their effective use is indispensable when a discourse is to be transformed into a set of state and/or structure descriptions without loss of the relevant content of the discourse as a whole.

Third, the kernelization component has to account for a speaker's ability to rephrase sentences or sets of sentences into a standard format. Semantic descriptions of both their operand and their transform are to remain equivalent (Chomsky, 1957; Harris, 1964). Some such transformations refer to kernelizations of a compound sentence, such as "he read an interesting book" $\longrightarrow$ "he read a book and the book was interesting," others produce information equivalent transforms of a kernel sentence, for example, "he drove the car" $\longrightarrow$ "the car was driven by him." But of particular importance are transformations that eliminate information which is not representable in the formalized language of the analyst, and is thus irrelevant for the intended inferences. For example, an analyst who is interested only in interrelations among actors referred to in a text may want to reduce the information represented in two sentences:

A British diplomat was forcibly detained by Red guards as he was getting out of his car. He was put on trial in the street and released after one hour of interrogation.

to "Red guards detained the British diplomat₁" and "the British diplomat₁ was put on trial by red guards" or even further "(active) Chinese/ vs./ (passive) British." The adequacy of such paraphrases obviously depends not on linguistic considerations alone, but to a large extent on information about the referential nature of the formalized language used by the analyst.

The function of the kernelization component may be shown analogously to the above by:



where the left side of the arrow denotes its input which takes the form of a concatenation, " $\sim$ ", of the semantic descriptions of the sentences of the text and the output is a set of state descriptions, structure descriptions and meaning descriptions.

Powers and Limitations

The grammar that I have been referring to is, to my knowledge, the only form that has lead to computable algorithms. Although its current stage of formalization is still too complex and computationally too expensive to show significant analytical advantages when compared with the linguistic efficiency of speakers, the progress so far achieved is remarkable. But, since I am not primarily concerned with linguistics, let me give illustrations of some of the other components of discourse models, however primitive their current manifestation may be.

In the few cases in which the output of kernelizations is actually written down, the transformation that accounts for it is achieved mostly by knowledgeable analysts and not by explicit processes. While this step can then not be

considered an explicit analysis, it nevertheless exhibits its significance whenever text is considered as having representational message characteristics. For example, Ole Holsti made use of a canonical statement format in which sentences representing actions and perceptions of actions of agents (within the international scene) could be recorded. The seven possible constituents of such state descriptions are:

- The perceiver
- The perceiver other than author of the document
- The perceived
- The action
- The object acted upon (other than an actor-target)
- The auxiliary verb modifier
- The target and incorporated modifier (North, et al., 1963: 137)

If the relationships expressed by a sentence coincide with those implied in the definitions of these facets, then the assumed content of the statement can be paraphrased and represented in such a canonical form. Thus the terms of the analyst's formalized language determine the kind of information that can be utilized for subsequent content inferences.

In an ongoing international study of values in politics at the University of Pennsylvania, we undertook to rephrase relevant portions of political speeches to make the structure within which political values are expressed available for subsequent inferences. (Krippendorff, 1966). Similarly, Collette Piault used a notational system consisting of sets of attributes, relations, references and two classes of objects in the terms of which interview data could be represented for further processing. But the kernelization was in all cases done cognitively, i.e. by the intuition of an analyst.

Regarding discourse logics, examples are fewer. When the content of a text is represented in some canonical form other than simple categories, most content analysts go immediately into enumerations, and thus approximate the limitations of association models. One good example of a discourse logic, primitive but nevertheless convincing, is incorporated in Charles Osgood et al.'s Evaluative

Assertion Analysis (Osgood, Saporta and Nunnally, 1956). The canonical form of its state descriptions consists of two linguistic items referring to different objects and an expressed relation between them. The relation is regarded as associative or dissociative, and, the affective evaluation of one object is known, by attribution or otherwise, while the evaluation of the second must be inferred. This inference is accounted for by the congruity principle of affective cognition. The algebraic operations of the discourse logic which this principle suggests are fairly simple and explicit. They purport to represent some structural features of the system under consideration.

While I regarded discourses as representative of states and structures of a source, they can quite often be considered as argumentative, in the sense that conclusions are developed and accepted more or less explicitly. Such discourses may reveal some aspects of the discourse logic underlying the use of references and contents. Edwin Shneidman, who made use of such information, suggested that there are individual differences in thinking or cognitive maneuvers which may be manifested in the idiosyncracies of either deductive or inductive reasoning, in the form or the content of the (explicit or implied) premises, in logical gaps or unwarranted conclusions, etc. Under the assumption that each individual employs an "idiologic" that is both consistent and acceptable to him, it seems possible to infer the logical conditions under which idiosyncracies of reasoning and cognitive maneuvers appear rational. In doing this systematically, the analyst constructs a discourse logic or "contralogic," as he calls it, which "would be that theoretical logical system (which might be operating unconsciously in the mind of the speaker) which would serve to undo or rectify or make reasonable the apparent idiosyncracies of the speaker's logical positions. Its purpose is to permit (the analyst) to see what is required - what the speaker must implicitly believe - to logically "explain" the speaker's own special logic (Shneidman, 1963: 183). Although Shneidman uses these logical constructs only

as an intermediate step to infer psychological traits, the work shows the need for discourse logics when an analyst considers verbal material as having referential contents.

From the examples that I have been citing it is quite easily imaginable that a full formalization of discourse models may become too complex to be practicable. Even if an analytical procedure is reduced to a specific discourse, models of the ability of a reader to cognitively handle information about the subject matter of a text require considerable amount of theoretical comprehension before they can be put into algorithmic terms. Nevertheless, I think this development of theory is a prerequisite for the design of computer programs that process the linguistic contents of volumes of verbal data automatically.

I think the best example of a discourse model of messages which has been fully computerized is described by Robert Lindsay (1963). It is too simple to be useful for practical analysis, but is excellently suited to demonstrate how discourse models of messages have to be constructed algorithmically. Robert Lindsay's program accepts only sentences in Ogden's Basic English and is aimed at representing and making inferences about kinship relations. Such sentences as:

Joey was playing with his brother Bobby in their
Aunt Jane's yard when their mother called them home

are first subjected to syntactic analysis from which syntactic characterizations of their sentential structure is obtained. A semantic analysis subsequently searches for all expressions that connote kinship relations. Sentences that are relevant according to this criterion are then kernelized and paraphrased to obtain state descriptions in canonical form of the type "Joey is brother of Bobby." The originally rich content of the discourse is thus reduced to the dimensions relevant for the intended inferences. The main objective of this work was to find an inferential memory that represented the discourse logic implicitly. Structural information about the source, the system of kin relations, was thereby assumed perfect. The discourse logic so constructed then accounts

for such inferences as from the additional sentences:

Bobby's sister Judy married Edward.

that Judy is Joey's sister, that Edward is Joey's brother-in-law, etc. Thus giving a clear demonstration of some understanding of what the discourse is about.

The program also demonstrates another feature of discourse models that contrasts with association models. From the above sentences some uncertainty regarding Jane's exact position within the kinship network still remains. But the reader is informed that Jane is either the sister of Joey's mother or she is the sister of Joey's father, but not both. As Lindsay points out, it would be inappropriate to assume "a connection such that a given stimulus will sometimes evoke one association, sometimes another on a probability basis.... (N)o reader would conclude half the time that Jane is the sister of Joey's mother and half the time that she is the sister of Joey's father, altering his decision from time to time" (Lindsay, 1963: 231). While it is not at all unreasonable to consider logical interpretations of probabilities for discourse models, a frequency interpretation of probability as required in association models would be entirely inappropriate here.

Discourse models of messages, the structure of which I have just characterized, are meant to represent a reader's ability to understand what a discourse is about. While such models render a text infinitely more informative about a source than association models can ever accomplish, even if their formalization were accomplished, they are still limited on several grounds. Let me mention only two basic sources of procedural inadequacy.

First, discourse models cannot handle the kind of outside evidence that an informed reader may utilize in determining which statements are true, invalid or indeterminate. To argue that a reader would reject a statement that appears contrary to experience has its analog in contradictions that may appear in the

discourse logic component. But to determine which of the contradictory statements have to be accepted or refuted requires information about those statements, such as the credibility of the source, which discourse models cannot handle. The same inability refers to attitudinal propositions and quotations. The sentence:

Brown said, "Red guards tried a British diplomat"

for example, is about Brown making a certain noise. That this noise can also be regarded as having content requires an additional level of discourse.

Second, when a source aims at certain effects, statements may be primarily of an instrumental character rather than representative. In such situations discourse models may yield entirely inadequate results. Arguing about the instrumental use of language, George Mahl enumerated the situations in which a child may utter "I am hungry." It may be used when it is unwilling to go to bed, when in need for attention, etc., and perhaps also when hungry. To consider the statement as referring to an existing state of hunger whenever it is uttered may be entirely misleading. (Mahl, 1959: 94). The same situation exists for the analyst of war propaganda who wishes to infer whether referred to reprisal weapons in fact exist (George, 1959: 148). Lies are after all the most extreme form of instrumental communications. If they appear in any shade, particularly when consistent with the remaining content, inferences from a discourse model of messages are bound to be fallacious.

The Domain of such Models

Communications such as exchanged in interpersonal conversations, political dialogues and between social institutions whether they are regarded as propaganda, official documents, ultimata, treaties, commands, expressions of compliance, etc., differ from discourses as considered above in at least three fundamental ways:

(1) Such communications, while undoubtedly employing certain references, are to a significant degree composed of sentences that do not convey a representational kind of information about states and the structure of a source. Questions, demands, requests, instructions, and greetings cannot be verified in the same way in which state descriptions or structure descriptions can be verified and can hardly be said to have content as far as discourse models are concerned. Yet such linguistic forms are significant for the understanding of interactions among language users. While sentences of this type do not primarily represent, their content may become manifest to an analyst in reference to interactions among communicators.

(2) Even when such communications have clear representational message characteristics, they may have to be viewed as instrumental in achieving certain objectives. Purpose is basic to all sources that can be attributed with some intelligence and in the case of human beings, instrumentality may enter all spheres of their overt behavior. Neither association models nor discourse models are powerful enough to consider purposive verbalizations. For example, a guest who may want to put his host in the position of offering him a drink by saying "it's really hot today" may or may not have made a true statement. But the assertion may trigger a behavioral trajectory that terminates at, among other things, the guest's obtaining a drink. If these consequences provide to an intelligent communicator the criteria for making choices among instrumental verbalizations, then the analyst has to search for the content of messages in their possible consequences.

(3) Such communications can therefore be said to occur in situations comprising several communicators, each pursuing its own objectives. The recorded text cannot then be considered a single consistent discourse but as representing a pattern of linguistic and non-linguistic exchanges between parties, a chronology of interactions among purposive communicators. Each of these exchanges is generated by one party and directed to other parties. Being a response to previous exchanges, each of them is assigned a point in time relative to each other.¹² The relevant context of sentences of the text has thus not only a linguistic dimension but includes the system of interactions and the changes in the parameter of such a system as well.

Perhaps one can appreciate the complexity of the source with which communication models of messages have now to deal when imagining a chess-like game¹³ in which each player chooses his own objectives and has some advantage in not revealing it to the other, in which rules are freely negotiable during the play and may indeed be violated, and in which each party may want to put only few of its pawns on the board and is free to choose to talk about the position of the rest. All that the analyst obtains is the chronology of moves and verbal exchanges. Discourse models would merely infer what pawns are being talked about. Association models would be entirely inappropriate since much of what is going on in the course of a play is not directly observable. Communication models of messages, on the other hand, are expected to render the recorded verbalizations informative about the implicit and explicit rules that develop in the course of a play, about the pattern of compliance to these rules, about the objectives on which each player may settle interdependently, and about the nature of the cooperative or competitive relation that may emerge between them. Thus, in his attempt to understand the system from the recorded exchanges, the analyst who makes use of communication models of messages may wish at times to outwit the players' intentions, predict the consequences of their moves, and describe the

interlocking properties of the play which govern both the linguistic and non-linguistic interactions. In other words, the analyst aims at inferring the structure of a dynamic system, its operating rules and controls from the recorded linguistic exchanges between, and interactions among, potentially purposive communicators.

Analytical constructs of communication situations that could render such a chronology of interactions informative about the parameters of a dynamic system or, more specifically, models of messages that identify the content of linguistic exchanges with the outcome of controls governing the interactions among purposive communicators, are extremely complex and difficult to formalize. I cannot claim to have solved any of the problems associated with such models, nor do I believe that algorithmic solutions can be found within a short period of time except, perhaps, for the most reduced cases. My confidence in the possibility of constructing communication models of messages lies in the fact that intelligent communicators continually use communication conceptions when either generating messages that have certain intended or unintentional effects or receiving and analyzing them in these terms. Even when those messages are exchanged between social groups or nations, analysts have been able to make rather reliable speculations regarding the patterns about which such messages may be informative. Systematic attempts to extract military intelligence from domestic war propaganda (George, 1959), the little published work of numerous foreign specialists who analyze diplomatic exchanges before adequate responses are formulated, and scholarly concerns with the possibilities of inferring whether the signatories of a disarmament agreement still conform to their commitments, (Singer, 1963) provide, if not examples of success, at least of reasonable hopes. I am therefore convinced that it may be possible to make progress regarding the understanding of communication models of messages if at least some of their formal prerequisites are clarified. I will start with the instrumental frame of reference.

Requisite Information Hierarchies

The last conference on content analysis, twelve years ago, introduced the issue of instrumental communications. Summarizing how far the discussion had gone, Ithiel de Sola Pool suggested four variables - the content (which was used almost interchangeably with our "text"), it's author's internal states, his manipulative strategies, and the states of the universe. Much of content analysis was then concerned with making inferences from text to an author's internal states according to an association model. "Instrumental" was attributed by Pool to "that which is manipulated (and thus varied in its relation to the thing being indexed so as to achieve the author's objectives.)" Relying on this association model, the assertion of the independence of manipulative strategies and internal states implies the absence of stable relationships between text and internal states, thus making the task of the content analyst extremely difficult (Pool, 1959).

Many every-day instrumental acts refer to the manipulation of causal chains. Wishing to enter a house, a visitor may have several possible acts at his disposal. A particular choice among them always represents the outcome of complex cognitive processes. Only the behavior is observed, however - a particular button is pushed and entry to the house is granted if certain other conditions are satisfied. Although correlations between objective (entering the house) and the observed instrumental act may be found, it makes little sense to explain instrumental behavior that way.

I think the simplest framework capable of considering instrumental acts is one that regards the action of an agent in reference to his attempt to keep some essential states (which may be subject to external disturbances) under control. At least the following may be distinguished:

- (a) The agent's essential states.
- (b) The voluntary strategies available.

- (c) The perceivable environmental situations.
- (d) The agent's knowledge about the changes in the essential states as a consequence of initiating certain strategies in given situations.
- (e) The agent's objective, a subset of the essential states.
- (f) A rationale (or principle of evaluation) for choosing among available strategies on the bases of the current essential state, the objective and the predicted consequences.

Even if the situation is simple, the alternatives are finite and enumerable, and the environment of the manipulating agent is a strictly causal one, the analyst has to find not only a representation of the information the agent uses, but also a representation of the information the agent possesses about the consequences of his strategies. Analytical constructs of instrumental behavior at once involve a hierarchy of types of information and their effective operationalization.

When the situation is such that the manipulating agent communicates verbally with other intelligent beings, his requisite knowledge increases tremendously in complexity. Even a rational child, for example, which considers lying to its parent will have to possess at least something equivalent to a discourse model that represents the parent's ability to understand its assertions. It will also have to have knowledge about the parent's access to factual information about the subject matter plus knowledge about the behavioral consequences conditional on their possessing the kind of information the child is considering to produce. More involved is the situation of a congressman who wishes to amend or to delete certain sentences from the Congressional Records. He has probably good reasons to take information about the English language for granted, but in order to assess the consequences of the sentences of his concern, the politician may have to consult his images about the political system within which he sees himself interacting with his colleagues, with the administration, with pressure groups

and with the public. Considering each of these potential recipients' expertise with the subject matter, their beliefs and values, he may have to estimate what message characteristics these sentences may have for them. Considering further their objectives and possibilities to express their consent or dissent to the proposal, he may have to ascertain how their responses might detain or facilitate his own political future, etc. In short, the representative is considering a network of possible interdependencies among purposive political subsystems in his environment, each of which must be characterized by a hierarchy of types of knowledge. Even if the analyst wishes to make inferences only about the intentions of the child's statement or of the politician's amendment or deletion, he will have to have constructs that are at least as complex as the information the manipulating agent uses in making decisions among possible instrumental verbalizations.

One of the crucial formal prerequisites of communication models of messages involving purposive systems is therefore an adequate representation of information about information about information, etc. Such a hierarchical structure already appears when statements are contrasted with information about what the statements claim to represent. The instrumental use of lies or inferences from apparent inconsistencies, as is typical of much of political analysis of documents, presupposes the ability to handle such representational hierarchies of information. Such hierarchies can become extremely complicated in typically human interaction situations. In the information about the opponent that the agent employs may be imbedded the opponent's information about the agent, as well as the information he possesses about the agent's information about him, etc. Representational theory handles such hierarchical structures only very clumsily. A recursive formulation of "information about" has to my knowledge not been developed. I believe that such a formulation is one of the prerequisites for constructing adequate communication models of messages when communicators can be attributed with some intelligence.

The Form of the Content Inferences

Let me leave the recursive formulation of representational information as an open problem and turn to the nature of the consequences with which communication models will have to deal, particularly, to the form of the inferential argument for which the analyst seeks structural information.

Suppose the state description "it's really hot today" is made at a party. Its factual content is quite trivial for it may be verified in reference to the present experiences of each participant. Neither is a unique motivation of the speaker immediately ascertainable from the statement alone nor is it likely that a unique behavior will follow. But the statement may impose a particular constraint on the consequent interactions, leaving open a large class of appropriate illocutionary responses. While demanding some recognition of its receipt, the statement may stimulate an expression of consensus or disagreement among participants and may establish a situation in which the host recognizes his chance to demonstrate his hospitality. The likely consequence of the statement is not so much a particular response but rather the exclusion of a certain class of initially possible responses, leaving a wide variety of choices to the participants. Thus content, according to this model of messages, might be said to become manifest in the constraints imposed on a situation as a consequence of linguistic and non-linguistic exchanges.

The content of instructions may be similarly considered. Whether they appear as rules of thumb, as sales guidelines or as national policies, their linguistic form can hardly be said to be descriptive of events or ideas. When instituted, they have a profound effect on the organization and coordination of behavior by excluding certain trajectories and leaving others open for individual- and situation-specific interpretations. The content of explanatory frameworks may likewise be assessed in terms of the structure they impose on the possible observations; the content of collective symbols may be seen to become manifest in their possibility to channel the diverse activities of individuals into a certain direction; and the content of political values can be regarded as becoming

evident in the kind of decisions they legitimize. Similarly, laws do not contain rules for good conduct but their content is negatively manifest by specifying the punishments that can be expected when criminal acts are exposed. Symbols, political values, and laws no doubt make up much of what is exchanged in a technologically advanced society. Such communications do not have referents, but may impose constraints on the subsequent behavior.

In their discussion of the instrumental use of language, Mahl (1959) and Pool (1959) give the impression that the antecedent "intent" of purposive verbalizations differ from their descriptive contents only by being latent and non-conventionalized. I think, however, that a consideration of messages as being informative about the direction of control of interactions by virtue of the constraints they impose on the possible consequences, differs from discourse models of messages in a more fundamental way.

The inferences that discourse models provide are usually positive in the sense that a given linguistic item refers, connotes or denotes a particular object or class of objects, and sentences describe particular states or structures in their terms. In contrast to this, communication models always regard content inferences negatively: the observer of a dynamic system involving symbolic behavior will have to consider all conceivable alternative trajectories, and try to ascertain why a large number of them could not occur after certain linguistic expressions were introduced so that the particular trajectory that was observed is one of those that was not excluded. The instrumental communicator within such a system of interactions will have to choose assertions that restrict the consequent acts in such a way that the remaining free variation conforms to his objectives. Similarly, the message analyst attempts to make inferences from the recorded interchanges as to the nature of the constraints that either exist and thus govern the system of interactions, or are subsequently imposed on a situation, leaving undefined however, exactly which behavior will in fact occur and exactly which internal states may have initiated the consequent constraint.

As Gregory Bateson remarked, the classical example of this negative form of inferences is the theory of evolution under natural selection. The theory suggests which organisms cannot be viable in a particular environment but is unable to say which ones will actually emerge. He goes on to say that:

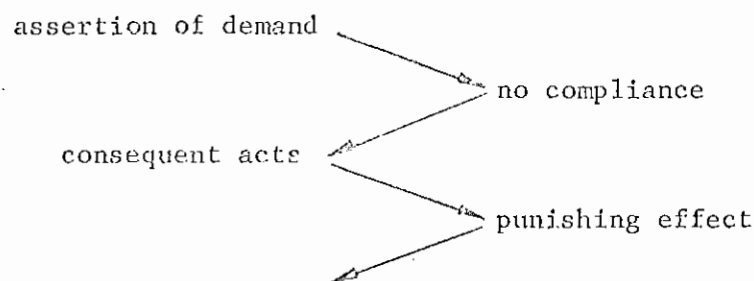
The negative form of these explanations is precisely comparable to the form of logical proof by reductio ad absurdum. In this species of proof, a sufficient set of mutually exclusive alternative propositions is enumerated, e.g. "P" and "not P," and the process of proof proceeds by demonstrating that all but one of this set are untenable or "absurd." It follows that the surviving member of the set must be tenable within the terms of the logical system. This is a form of proof which the non-mathematician sometimes finds unconvincing and, no doubt, the theory of natural selection sometimes seems unconvincing to non-mathematical persons for similar reasons - whatever those reasons may be (Bateson, 1967).

In the biological sphere, evolution by natural selection is an unidirectional process: there is no feedback to parent generations. Instrumental communications, and consequently, the control processes they establish within a system of interaction, are critically linked to conceivable feedback loops and presuppose a circular form of content inferences with which other models of messages are not concerned.

The child which doesn't mind lying may consider giving a description of the events that not only structure its parent's perception but subsequently prevents the parent from imposing undesired restrictions upon the child. Often though the child is not sophisticated enough and considers only one such inferential loop while the parent may consider further feedback loops to estimate the degree to which the statement may be trusted. Similarly is the congressman who subsumes his speech under political objectives bound to make his inferences along the circular flow of consequent events. At each stage he may want to consider the extent to which his speech imposes a constraint on the situation, what other constraints exist, and how the series of consequent constraints ultimately control his own variety of possible acts.

While state descriptions may be said to impose constraints on subsequent behavior as a secondary phenomenon, a large class of linguistic forms pertain primarily or exclusively to such constraints. This is particularly true for

demands, claims, treaties, etc. Demands may be "verified" by compliance and the content of demands thus becomes manifest in the system of interactions among at least two communicators. In particular situations, the assertion of demands implicitly or explicitly informs the recipient about rewards and punishment consequent to his choice of a particular behavior, and may force compliance by making these conceivable consequences credible. The communication of demands cannot therefore reasonably be made unless it structures at least two interaction loops:



In order to understand and describe the structure of communication situations in which linguistic exchanges determine the parameters of the interaction, the task of the analyst becomes one of inferring from the chronology of exchanges the circular form of mutually imposed and interlocking constraints. The form of content inference that communication models of messages are intended to facilitate may therefore be said to be:

1. Negative, i.e. it entails the ascertaining of the constraints imposed on a variety of possible consequences rather than the isolation of a particular trajectory,
2. Circular, i.e. it is based on inferring the contents of linguistic exchanges along the possible chains of events each ultimately closing at their respective origins rather than on inferring in one direction only, and involves
3. Analytical constructs of control with some order of prediction for rendering the recorded text informative about the interaction parameters of the source.

These circular inferences, which theoretically could go on ad infinitum, may find their definite limitation in the hierarchy of information that each party possesses about the information each other party possesses etc.. Once this information is exhausted in this circular extrapolation from past interactions, very little can be said beyond it. But practical limitations are more likely to set the limit on the understanding of the system of interactions: With each inferential loop the problems spiral to increasingly unmanageable proportions.

Some Manifestations of Constraints

This peculiar nature of the content inferences that communication models provide profoundly affect their possible validation. While there is no operational test for the procedural adequacy of discourse models (Chomsky, 1957), their performance can be at least checked against the ability of knowledgeable speakers of a language to understand what a discourse is about. Intersubjective agreement almost belongs to the very definition of "language." The relations among communicators that develop in the course of verbal exchanges are, on the other hand, rarely so institutionalized and their assessment requires considerable insights as far as the analyst is concerned.

I mentioned that the recorded text can be regarded a chronology of exchanges between communicators which are patterned according to time, place of origin and destination and may contain references across these exchanges as well. As Ross Ashby and Charles McClelland suggest, the analyst, who attempts to understand the source's system of interaction, will have to infer from this record the existing and consequent constraints accounting for and imposed upon the nature of the source (Ashby, 1958; McClelland, 1964). Difficulties arise out of the fact that this chronology represents only a single trajectory of interactional behavior and provides no obvious evidence of the trajectories that were excluded in the course of the recorded process. Even when the chronology covers a long period of time, the number of possible trajectories is often so large that they

cannot be "acted out" systematically. When the interaction situation is relatively stable, i.e., constraints are invariant, inferences about their existence still remain difficult. For example, if all citizens would confine their behavior within limits that happen to be prescribed by law, it would neither be possible to ascertain the limits prescribed by law from the behavior observed nor could it be ascertained whether the law is in fact effective. Similarly, a naive observer would have a hard time inferring the rules that are effective from the chess players' moves. In both cases linguistic and non-linguistic behavior may have to be consulted.

I see essentially three ways of obtaining evidence for the existence of symbolically induced constraints. The least reliable inferences may be made from explicit compliances to demands, from pledges or from commitments, whatever form they may take. Layman Allen, for example, showed how many possibilities are left open to the signatories of a segment of the nuclear test ban treaty (Allen, 1963). And the analysis of political values in decision making which is proposed by Philip Jacob (Jacob, et.al. 1962) is a similar attempt to ascertain constraints on alternatives that are accepted within a source for whatever reasons. But treaties may be made with the implicit understanding that they can be broken and political values may be asserted without making decisions accordingly. Thus, if taken alone, the validity of this form of evidence is highly questionable.

Evidence for the existence of constraints may, secondly, be found in the communicator's account of his insights about the excluded alternatives. Private diaries by political decision makers often provide such information. For example, when choices among possible actions are justified in the light of the undesirable consequences that result from some of them, the severity of situational constraints reveal themselves quite clearly. The expressed insights of our thirsty guest at the party may similarly exhibit the nature of the existing constraints. He may reason like this: 'I will loose my status as a guest if caught grabbing a whiskey bottle, I will be judged unrefined when asserting that

I am thirsty; I cannot afford insulting the host by asking why he didn't serve drinks, etc.' The assertion of a statement which survives this negative form of reasoning will not reveal very much about the structure of the situation. While this form of evidence may be particularly open to certain interview situations when communicators view their verbalizations instrumentally, the analyst rarely can rely on it.

The third form of evidence may be found in the consequences of violating a constraint however it was introduced. This again exhibits the control aspect with which communication models are essentially concerned. It suggests that the seriousness of promises could be inferred from the consequences of not sticking to them; that the power of demands becomes evident in what follows from failures to comply; and that the reality of commitments appears in the condemnation of deviations. In the extreme, the assessment of the content of law would require to study the crimes that are identified and punished according to the text. This would reveal which paragraphs are merely paper within a legal system and which effectively limit the possible behaviors of citizens. When less institutionalized forms of interaction are analyzed, the identification of incidents of violation and condemnation is not always an easy matter. Even the identification of provocative and conciliatory moves involves a considerable amount of information about the structure of control processes within the source without which communication models do not yield adequate content inferences.

I hope it is quite clear from my discussion that the analytical constructs of control processes involving higher orders of prediction from verbal interactions are very little understood and demand considerable investigative attention before rigorous message analytic procedures can be designed. There is no single form of evidence for the existence of controls affected by the linguistic and non-linguistic exchanges. The analyst has to utilize all of them simultaneously and particularly consider apparent inconsistencies, violations and justifications in order to develop suitable constructs of control which in turn will help him to assess the variety-limiting consequences of exchanges. Current attempts to

obtain evidence about control relations that emerge between nations, social organizations or individuals are either extremely reduced (to non-verbal interaction) or remain on the level of post hoc explanations. Perhaps the work of the Palo Alto group which recently presented a nice analysis of the interactions depicted in Albee's Who's Afraid of Virginia Woolf (Watzlawick, et.al., 1967) could provide a starting point.

Although I cannot point to any noteworthy formalization of communication models of messages, they all involve extracting from a chronology of linguistic and non-linguistic exchanges the following:

- (a) Information about the identity of the basic communicators of the source and their boundaries.
- (b) Information about the states of each component of the source including the communicators' possible perceptions of the situation, their communication and behavioral strategies, evaluative frameworks and objectives.
- (c) Information about the transmission facilities, time delays, channels and stable relations between the communicators.
- (d) Information about the existing constraints that have evolved in the course of previous interactions, i.e., the system's basic operating rules and parameters, the definition of the situation and of the communicators' roles, shared or not.
- (e) Information about the mechanisms of control and the regulating power of the exchanged verbalization which structure those mechanisms.
- (f) Information about the hierarchical structure and quantity of knowledge available to the communicators about the possible dynamic interdependencies between the source's components.

With this information, the analyst may be able to develop a specific model of the communication situation involving analytical constructs of control. These may render the recorded linguistic exchanges within a source informative about the structure of interaction and its dynamic consequences.

CONCLUDING REMARKS

Let me try to summarize some of my points. I think it is important to conceptually abandon the idea of analyzing the content of a message. Content cannot be analyzed but it may be inferred by an analyst in reference to some source against the behavior of which content inferences may be validated.

By defining message analysis as any scientific method for making specific content inferences from recorded text I wish to emphasize that it is the analyst to whom a text may become informative about unobserved states, events or phenomena of the source; furthermore, analytical constructs for making the inferences should be explicit and open to detailed examination independent of the particular situation in which they are applied. Where explicit techniques are merely analytical aids and the crucial process of making inferences is left to the insights and cognition of a human analyst, I suggest that the term "message analysis" be avoided.

The choice of a particular analytical construct for the analysis of messages evidently implies certain assumptions regarding the nature of the source. This raises the important question of the adequacy of such constructs in particular situations. But regardless of whether such questions are answered affirmatively or not three prototypes of analytical constructs or basic models of messages seem to be distinguishable. I referred to them as association models, discourse models and communication models respectively. Their crucial difference appears (a) in the assumptions made about the structure of the source, (b) in the kind of information relevant for designing the required analytical procedures, (c) in the structure that is initially imposed upon the input data when recording them, (d) in the message characteristics that the data acquire in the course of the analytical process, i.e., the inferred content, and (e) in the kind of evidence required for

	ASSOCIATION MODELS	DISCOURSE MODELS	COMMUNICATION MODELS
SEMANTIC RELATION OF MESSAGES	Statistical dependencies: associa- tion, correlation, causal or not	Linguistic reference: denotation or connotation	Controls or inter- actional consequences
ASSUMED STRUCTURE OF THE SOURCE	Finite state, ergodic, and stochastic source with multi-variate events	A language together with an object system (of ideas or events) to which it refers	Linguistic and non- linguistic exchanges among potentially intelligent and pur- posive communicators within a system of interactions
INFORMATION RELEVANT FOR ANALYTICAL PROCEDURE	Multi-variate probabilities of co-occurrences or tran- sitions between observable events	Nature of linguistic processes of analysis and understanding of what linguistic forms are about	Nature of control mechanisms implicit in communication net- works and consequent to verbal and non- verbal exchanges
INITIAL STRUCTURE OF THE RECORDED TEXT	A set of constituent elements (recording units) without regard for their order	A string of linguistic items with special attention to their order of occurrence	A (space,time) pattern of exchanges of strings of linguistic items and non-linguistic events
FORM OF THE INFERRED CONTENT	Frequency-probabilis- tic characterizations of state descriptions of potentially observable components	State descriptions of unobserved events implied by what the text refers to	Representations of effective constraints imposed on the inter- action among communicators
EVIDENCE REQUIRED FOR VERIFICATION	Observational confirmation of "predictions"	Judgments regarding the validity of inferred state descriptions made by native speakers of a language who are familiar with the source	Evidence about the purpose of demands and pattern of com- pliance, insights in- to the reasoning about available alternatives, mani- fest violations of constraints

A Comparison of Models of Messages

Figure 4

verifying the content inferences made. Let me represent these differences tabularly in Figure 4 without reviewing them in detail.

With this differentiation I do not wish to imply that such models provide mutually exclusive alternatives for an analysis. Communication models often presuppose and incorporate the information provided by both discourse models and association models. If it is compatible with an analyst's inferential aim then the statistical operations of association models may well be applied subsequent to the algebraic operations of a discourse logic. However, the analytical functions of these models, their logical possibilities and limitations should be understood.

If one prefers semiotic terminology such as that of Charles Pierce (Burks, 1949) then one would probably have to say that association models consider a text as a set of "indices," discourse models regard a text as a pattern of "symbols" while the view of communication models would have to remain unlabeled although subsumable under the pragmatic branch of the theory of signs. But this apparent congruency with semiotic terminology is only a superficial one and may become misleading when specific investigative techniques are discussed. If one shares the semioticians' search for the relations according to which symbols are interpreted then one would have to say that association models are concerned with correlational dependencies, causal or not; discourse models deal with systems of linguistic references, denotations or connotations; and communication models consider controls or interactional consequences. But these are only convenient labels.

I do think that the concern with models of messages is more productive for the study of social communication than the semiotic approach has been. This is because the former aims at representing partial theories of a source, i.e., its symbolic processes, with which the latter has not been able to deal. Let me give just one example of the confusion that results from such global labels as "symbol" and its "interpretation." At a recent conference, Jurgen Ruesch and Samuel

Eisenstadt got into an interesting argument about whether a system of symbols, in order to be effective within a society, require homogeneous or heterogeneous interpretations. Ruesch exemplified his point by referring to traffic signs the heterogeneous interpretation of which would result in disastrous traffic accidents. Eisenstadt, on the other hand, referred to "The Rock of Israel" which is known to connote quite a number of things to different citizens of Israel without making the symbol less powerful in regard to the national identity it promotes (Thayer, 1967: 473-476). It seems that it is just because the intent to survive the traffic is shared by a population of drivers with approximately equal power to influence the situation that the interpretation of traffic signals can be reduced to discourse models. When a political symbol is chosen to organize and channel a large variety of different activities, each guided by potentially different objectives, such reduction may not be appropriate. In each case the term "interpretation" has to denote quite different processes although all may involve inferences as to what the symbol relates to.

Only in part have I mentioned the possibility of computerizing these models. Let me make only a few comments on this problem. Regarding association models, I see no serious obstacles. Computer programs for statistical procedures are easily available although not all of them accept verbal data as inputs. In this respect the pioneering work done by Philip Stone et al. (1963; 1966) should be mentioned.

Regarding discourse models the situation does not look as favourable. Programs providing semantic characterizations of natural language sentences currently require an undue amount of time and their results are not always useful. In order to come to more practical algorithms it is probably advisable to accept goals that are less ambitious than those considered by linguists. But even if the obstacles of such semantic characterizations were removed, I suggest that it is impossible to expect general algorithms for the analysis of all conceivable discourses. The

information that would have to go into such a discourse logic would have to represent all a speaker knows about the world. But I do believe that it is possible to develop discourse logics for limited domains or specialized subject matters, the structure of which is known or not too involved. Kinship relations is but a primitive example of certain list structures into which other discourses may be mapped as well. Available simulation languages may set limitations for such content inferences. I see the formalization of specialized discourse logics and compatible kernelization procedures as the most important step towards inferring a text's referential content.

I think, the problems of computerizing communication models of messages are extremely difficult to solve. Clearly, their formalization presupposes both adequate association models and adequate discourse models. But I wonder if the currently available software is capable of representing systems of linguistic and non-linguistic exchanges among intelligent communicators. Perhaps this kind of message analysis is bound to be made by human analysts who can specify the constraints of a situation more easily using computers merely as aids for conceptualization. Even the most reduced attempt to formalize communication models of messages would be a great step forward. Whether this is possible at all I am unable to judge.

Let me close by suggesting that much of our concern with the content of messages is to discover the non-obvious, to infer what is hidden, to gain information about what cannot be seen, and to make messages out of signals that remain signals for others. It always requires an analytical sophistication that is greater than that possessed by the source. If analysts reduce the power of their analytical facilities for the sake of efficiency, or in compliance with narrow scientific standards, then their inferences may become quite misleading. Almost always is it possible for an intelligent source to outwit an analyst with a reduced repertoire

of models of messages by relying on a way of concealing or conveying significant information that is more powerful than his models can handle. It is for this reason that I call for a thorough examination of the adequacy of available analytical constructs of messages in the light of known or conceivable sources of information.

FOOTNOTES

1. It should be noted that I use "source" to denote any kind of system that is identifiable by its variables in the analyst's environment and of which some information is available. A source in this sense includes a situation in which two human communicators or social organizations interact through the exchange of signals or messages. Such situations are often described in terms of "source" or "sender," "transmitter" and "receiver." The term "source" as used in this paper is not limited to the denotation of single communication agents that are identified because of their sending signals to some other agents; it is more general.
2. Sometimes "meaning" is understood to refer to the rules accounting for the use of sign-vehicles or signals in particular contexts. An object that possesses meaning in this sense may be said to be one for which a receiver has some such rules. The arrow in the diagram then denotes that particular meaning which relates a received signal (the raw data) to some contents (the inaccessible states of the source) and through which messages are realized. Although the generalized message analytic process can be quite adequately depicted by the process:

Signal -----> Content

when the received signals are members of a language-like system of representations, "meaning" has been taken to refer only to a part of this inferential process.

3. This definition deviates in several respects from definitions of content analysis of which the one attributed to Berelson is by far the most popular: "Content analysis is a research technique for the objective, systematic, and quantitative description of the manifest content of communications" (Berelson and Lazarsfeld, 1948:5). By leaving the crucial term "content" undefined, the definition fails to delineate the empirical domain of the technique. References to "objectivity," "system," and "quantification" merely stipulate that the technique conform to scientific standards.

Among the most recent definitions is the one proposed by Ole Holsti which reads: "Content analysis is any technique for systematically and objectively identifying specified characteristics of messages" (Holsti, 1966:7). Here the process of making specific inferences which probably offers the most crucial distinction between treating data as observations, and treating data as messages about unobserved phenomena, is not recognised. Content analysis is then often reduced to a technique for characterizing the occurrences of the constituent elements of a text. The significance of content inferences has been emphasized by Alexander George (1959), Charles Osgood (1959:36) and George Gerbner (1958:86).

4. A good example is the use of factor analytic techniques. The process typically involves the following: First, a text is scored on many dimensions, each of which is intuitively meaningful and named in accordance with the analyst's conceptions. Second, an explicit statistical procedure is applied which identifies correlational clusters or factors. Third, the analyst attempts to make sense out of these clusters of dimensions and tries to find suitable con-

cepts and accompanying names based upon inspection of the semantic interpretations of these dimensions that constitute the cluster. The explicit procedure merely eliminates correlational redundancies. The way this is accomplished has very little to do with semantic processes or those of cognition. The difficult job of a semantic interpretation of the results is then entirely left to the analyst's intuition.

5. What I call observational adequacy should not be confused with reliability as measured by the amount of agreement achieved during a recording process. Reliability is a prerequisite of analytical success but it does not in any way assess whether significant information is maintained during a recording process.

6. Informativeness within association models can be given a more precise notion by means of Shannon's information theory. If C is the set of possible contents of interest to the analyst, and $H_m(C)$ is the partial conditional entropy in C , the particular measure m being known, the information I that m conveys about C is

$$I = H(C) - H_m(C)$$

7. In terms of information theory (see footnote 6) this is due to the fact that whichever two measures m_1 and m_2 are given

$$H(C) - H_{m_1}(C) \leq H(C) - H_{m_1 m_2}(C)$$

8. This has been the main argument of the transformational school of linguistics, particularly of Noam Chomsky (1957), for a recursive description of grammar.
9. It should be remarked that whenever traditional content analysis aims at describing the manifest content in the author's language, such a situation in fact exists. When such content analyses follow purely descriptive aims even logical implications are supposedly excluded.
10. This point is reflected in László Antal's work. He argues that the sentence: "The sum of the angles of a triangle is 180 degrees," is meaningful to whoever is able to give a semantic description of the sentence just on the basis of the knowledge about the use of its constituent words and their relative syntactical positions. But for an understanding of what the sentence is about, i.e., for a comprehension of its content, other than linguistic knowledge is required. Evidently, an English speaking child may be able to describe the sentence semantically without understanding it. The ability to semantically describe a sentence is a prerequisite for its understanding. "The purpose of the sentence, and indeed that of language as a whole, is to convey content, and both form and meaning (syntax and semantics) are the means to achieve this end." (Antal, 1964: 24).
11. In a discussion of "grammatical meaning" Roman Jakobson reports that "Dell Hymes actually found an application for this sentence in a senseful poem written in 1957 and entitled 'Colorless Green Ideas Sleep Furiously'" (Jakobson, 1959: 144).
12. It should be noted that several studies have recorded the direction of exchanges. In his canonical recording format, Ole Holsti recognizes at least the producer of the statements and the perceiver of the situation to which they refer. (North

et al., 1963:137). Another way of recording interactions is suggested by Elihu Katz et al. who proposes to analyze the nature of persuasive appeals that clients of a formal organization use in support of requests for services. The six-faceted canonical form includes the clients' perceptions of his role in relation to that of the formal organization. (Katz, et al., 1967). Such ways of recording do not necessarily produce chronologies of interaction of the kind communication models require, particularly when the verbalizations of only one party are considered and when the order of the exchanges is neglected so as to make the text amenable to statistical description.

13. In a standard game of chess verbalizations exchanged between experienced players are irrelevant to the game. Rules are not negotiable and information about the state of the play is always perfect. Communication models of messages would hardly be appropriate.

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