

**NEGOTIATING REALITY: USING LANGUAGE AND INFLUENCE DIAGRAMS
TO ARTICULATE KNOWLEDGE**

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ABSTRACT

This paper analyzes some of the recent literature on language and information processing, focusing on graphic representations which model the interactions between those transmitting and those receiving messages. Having examined four models concerning interpersonal communication and information processing, I conclude that today's most promising research on dyadic communication is that based on the model of cybernetic control systems. Most useful are the models which 1. recognize the need for the speaker and listener to commit themselves to continue the dialog until they arrive at consensus and 2. also recognize that the recursive interactions between the two individuals are based on the principle of **feedback**, which, in the words of Norbert Wiener, "is the property of being able to adjust future conduct by past performance"(Wiener, 1954,33).

"A fool sees not the same tree a wise man sees." William Blake (1790)

For much more than 200 years poets and philosophers have been struggling with the mysteries of the human mind, imagination, and perception. Increasingly, researchers in artificial intelligence (AI), in their attempt "to design computer tools suited to human use and human purposes" (Winograd and Flores, 1986,8) are studying what happens when two people use language. What happens when the fool tries to communicate to the wise man about the tree the fool sees? And how can the wise man communicate about the tree he sees? We now know that Korzybski was correct in recognizing that "The map is not the territory," and that each individual carries in his/her own head maps or mental models of reality formed by that individual's own life experiences. In other words, the word or symbol is not the reality it represents, and the words represent different interpretations of reality to each individual. Small wonder then that our lives, professional and personal, are fraught with miscommunication.

I. LAYERED MODEL OF INTERPERSONAL COMMUNICATION

Recent studies of human communication have challenged the Shannon-Weaver sequential linear "transmission" model as inadequate for representing interpersonal communication. The authors of one of the most recent and insightful models, the Targowski-Bowman Communication Model: Layer Based Links (1988) observe that the Shannon-Weaver model is seriously limited as it addresses only the transmission of physical signals, and ignores interpretation and **meaning** (Bowman and Targowski,1987,24).

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Targowski and Bowman do address the question of meaning, or more specifically, what happens between the senders and receivers of "the message" when people use language. They argue that:

"When a sender and receiver communicate, they obviously do so in a cultural context that contains both shared and private meanings, and these meanings influence the net result of the communication between them. Shared meanings include both cultural meanings and those established by the immediate environment in which the communication occurs. These meanings will differ in saliency, with some being (or seeming) more important than others. This results in a layering of meanings"(1988,9).

One purpose of the Targowski-Bowman model is to address not only syntax and semantics, but the very important element of "the accumulation of information"(1987,33) which includes the experience of the individual and what semiotician Umberto Eco calls "the encyclopedia"(1988,43) or the cultural and historical experience of a society. The authors of the model rightly observe that:

"Because the semantic reactions in the minds of sender and receiver depend more on the information each brings to the communication process than on the message communicated, even the best message properly delivered in a given situation may be misinterpreted"(1987,33).

They argue, furthermore, that their "layer-based links" model shows how "multiple levels of information are exchanged among sender, receiver, and environment"(1988,10). See figure 1 below.

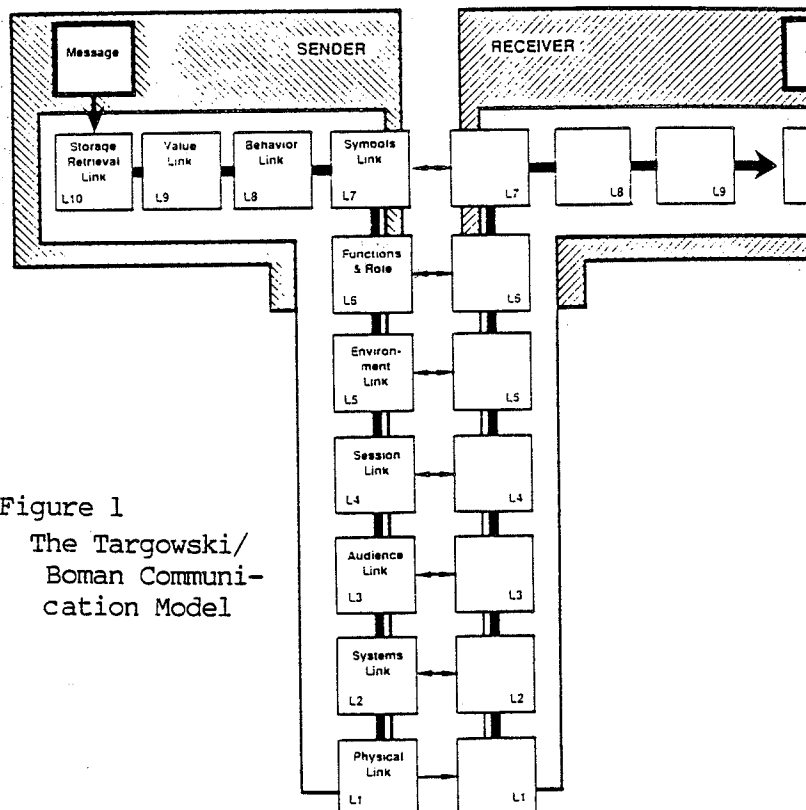


Figure 1
The Targowski/
Boman Communi-
cation Model

The links start with level 1, the physical medium used for the exchange of messages, such as paper or telephone or electronics, and rise up the chain to level 10, the effect of the short term and long term memory and of the communications skills -- transmitting and receiving -- of the sender and the receiver. The links also include the attitudes of the members of the dyad to the physical medium of communication (level 2); the attitudes of the communicators to themselves and to each other (level 3); the effects of the time and place of the session (level 5); and the difference in status between sender and receiver (level 6). It seems to me that as we progress up these levels, we get further away from what can be objectively described, (i.e. paper or telephone, or the relationship between supervisor and subordinate), and further into the black box of the mind engaged in the communication process. For example, level 7 concerns the "degree to which sender and receiver correctly interpret each other's verbal and non-verbal symbol systems"; level 8 addresses "the expected and observed reactions to a particular message"; and level 9 is concerned with the extent to which sender and receiver share the same values. At level 10 we are definitely into the black boxes, the minds, "the storage/retrieval links" of the sender and receiver. At this highest level, the whole of the individual's long and short term memory, including his/her mastery of communication skills, influences the ways in which the messages are sent and received (Targowski-Bowman, 1988, 11-19).

While the authors offer the disclaimer that this is "only the first step"(24) of an in-depth analysis of dyadic communication, there are some serious deficiencies of the layer-based link model. First, the model is hierarchical -- layered -- and implies a sequential order of events and cognitive processes, while in fact the interpersonal communication process is both recursive and simultaneous, with both speaker and listener using simultaneous processing for the information flowing up and down the links and along the paths mapped by Targowski and Bowman. Furthermore, 'links' carries connotations of a chain, and with it associations of rigidity which are inappropriate for the fluid and volatile process the model describes.

The authors admit that communication is dynamic and that a message is not conveyed the way a "football is passed from a quarterback to a receiver." Yet even though they appear to recognize the need for feedback loops in communication models "so that senders can repackage and redeliver any 'footballs' of information that go astray..."(1988,15) the diagram of their layer-based link model appears static and rigid compared to the fluidity of feedback loop influence diagrams as used by system dynamicists.

A second problem with the Targowski-Bowman model is its over-emphasis on the cognitive process, as though we understand clearly exactly how the human mind processes information. It may well be that non-cognitive elements, those processes that operate beyond our levels of conscious awareness, are more important than the modelers allow. Linguists, psychologists, and semioticians are not entirely certain about how human memory works.

In a witty fictitious dialog between a computer and a professor of cognitive sciences, the computer says of its masters:

"They are very uncertain about what they have inside them....That is the reason why they set me up. They know what I have inside me and when I speak in a way that they understand they presume that they have the same software inside them" (Eco,1988,59).

In other words, it is largely by the efforts of researchers in AI attempting to make computers "think" that we are gaining insights into human information processing. However, the layered model of Targowski-Bowman, and the knowledge acquisition and memory access models described in the next section rely rather too heavily on unproven assumptions about how human beings really process knowledge. The most promising model, as I shall show in the last section, shifts the focus from what goes on in the individual's mind to the individual's attempt to negotiate reality with another individual; or, in other words, to ascertain whether s/he sees the same tree the other sees. But next we shall examine some models of intrapersonal communication.

II. KNOWLEDGE ACQUISITION AND MEMORY ACCESS MODELS

In contrast to the theoretical approach of Targowski and Bowman, the methodology of information processing in advertising, which builds on models of knowledge acquisition and memory access, brings together researchers from various fields, including cognitive psychology and linguistics. These two models, unlike the interpersonal model discussed earlier, are intrapersonal; they speak in terms of "the cognitive processes that extract the conceptual content for a text or a discourse" (Lehnert, 1988, 155). In effect, then, this line of research is a kind of "applied epistemology"(157) or, in other words an attempt to ascertain how we know what we know so that we can design intelligent computers.

Lehnert's memory access model, building on the work of Tulving, distinguishes between semantic vs. episodic memory. While semantic memory deals with generic terms, like **dog**, episodic memory tells about a specific dog, like Spud on television commercials. But it is not always easy to distinguish where one kind of memory ends and another begins when we process language. To illustrate the difficulty of deciding whether a proposition is processed as a universal, generic or an episodic truth, Lehnert asks how we would process the statement "Do penguins have skin?" and then diagrams a hierarchical structure to manage the generalizations in the deductive reasoning process. See figure 2 on the next page.

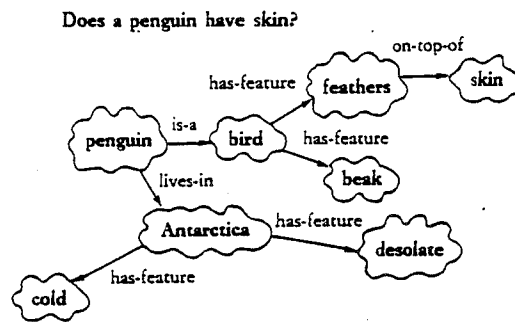
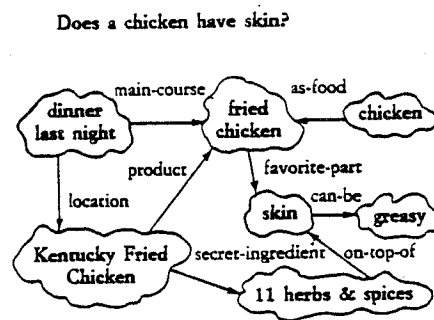


Figure 2

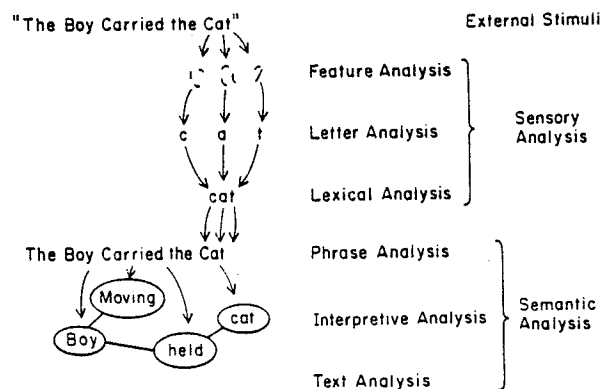
Semantic memory vs.
Episodic memory



According to Lehnert, figure 2 "shows a fanciful picture of semantic penguin memory vs. episodic chicken memory to illustrate the difference more concretely. The general point is simple: given any 'semantic proposition, it is possible to imagine an episodic structure that could encode the information under consideration....The controversy in artificial intelligence between semantic and episodic memory goes far beyond natural language processing applications. Proponents of production-based expert systems are banking on semantic knowledge, while people who argue for case-based reasoning are committing themselves to episodic memory structures" (Lehnert 170-171).

A similar model of information processing in advertising by Andrew Mitchell is based on the premise that "semantic knowledge and episodic knowledge seem to be linked" (Mitchell,1983,19). Mitchell views the knowledge acquisition process as one in which information from the environment is interpreted and then a representation of this knowledge is stored in long-term memory. See figure 3 below.

Figure 3



Mitchell's illustration of this process, shown in figure 3, represents semantic knowledge as a "network of associations"(18). He emphasizes that "the semantic interpretation of the phrase [the boy carried the cat] that is stored in semantic memory is not the actual phrase." In other words, we interpret or translate messages before storing them in knowledge structures. Mitchell views knowledge acquisition as "a serial process with the individual playing a passive role," although he does mention, but does not elaborate upon other models that show simultaneous processing of information at the sensory and semantic levels.

The focus of Mitchell's research is to assess information processing in advertising. He posits that consumers "have packets of information about different brands and about specific products...organized into a network of associations" (Mitchell 20). See figure 4 on Ford Fiestas below.

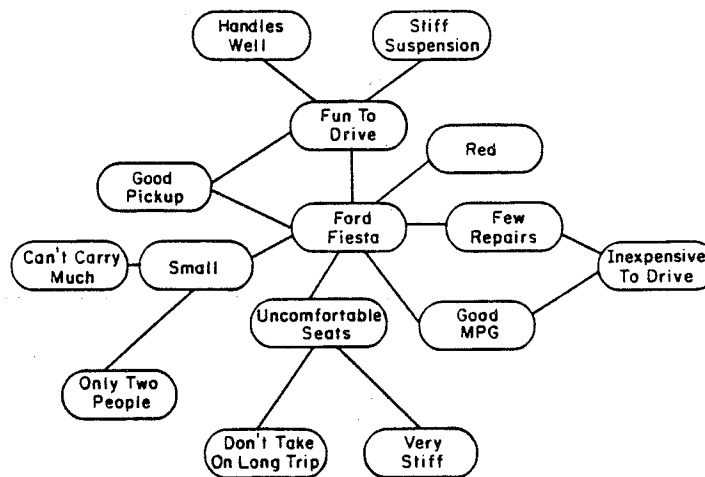


Fig. 4 A packet of information about Ford Fiestas.

According to Mitchell, this network of associations suggests that semantic memory stores knowledge at different levels of generality; that there are horizontal (Ford Fiesta-few repair) linkages; and there are vertical linkages (Fun to Drive-Ford Fiesta) (20). Significantly, he fails to note that key phrases in these links -- FORD FIESTA, FUN to drive, FEW repairs -- are alliterative. The copy writer for this campaign astutely observed that alliteration, an ancient poetic technique, helps consumers to learn and to link these positive associations with their product.

While the work of Lehnert and Mitchell and others sheds some light on human information processing, many questions remain unanswered. There are, moreover, some serious limitations to their models. For example, in her quest for mathematical vigor, Lehnert focuses so closely on the trees--in this case nominal compounds--that she may have lost sight of the forest, i.e., the larger picture of how our mental models develop as a result of our own individual and collective experience in a society. Mitchell's model also is too limited in scope and in depth. He merely states what he imagines is going on in the black box, conjecturing, not proving, vertical and horizontal linkages.

One point on which most researchers agree is that knowledge is always interpreted, translated, or paraphrased before it is stored in semantic memory. The "message-in-itself" does not go directly into storage because in order for the message to be received it is filtered through the previous experience of the listener/perceiver; this experience includes not only that of the specific receiver of the message, but also, according to semioticians, the whole "cultural repertoire of a given society, its historical memory" (Santambrogio et al., 1988, 22).

Attempts to provide computers with modules of our "cultural repertoire" and "historical memory" so they can process data intelligently are being developed by Roger Schank and his team. They came up with Scripts, "a sequence of conceptualizations with some variables in them," such as the "Restaurant Script," which attempts to encode the sequence of events one experiences when dining at a restaurant (Schank and Kass, 1988, 190). They then developed a more refined system, called MOPs (Memory Organization Packets), which allows scripts to be "modified dynamically" by using smaller modular units of scripts, such as the waiting room scene, which might be appropriate for several types of experience, such as a waiting room in a doctor's office, a lawyer's office, or a personnel office (192).

Research using associative networks, such as Scripts and MOPs, is interesting because it may provide some knowledge about how the human mind processes information, but I believe the research models based on feedback are the most promising for understanding how interpersonal communication really works.

The most realistic models recognize language and cognition as social phenomena. I agree with Terry Winograd that:

"Knowledge and understanding (in both the cognitive and linguistic senses) do not result from formal operations on mental representations of an objectively existing world. Rather, they arise from the individual's committed participation in ... a socially shared background of concerns, actions, and beliefs" (Winograd and Flores, 1986, 78).

III. CYBERNETIC MODELS BASED ON FEEDBACK

The most insightful research on cognition and human communication recognizes the following:

- knowledge is the result of interpretation
- knowledge is neither subjective nor objective
- language and cognition are fundamentally social
- communication demands commitment

Most important, communication to establish consensus, to "negotiate reality," is a recursive process based on feedback.

Terry Winograd's diagram of a conversation for action, i.e., a conversation which commits the speaker to a course of action, in contrast to the models discussed above, does not focus on the receiver's or speaker's mental state, but instead "shows the conversation as a dance" (64). Based on Austin's and Searle's work on speech act theory, Winograd analyzes the structure of utterances and "patterns of commitment entered into by speaker and hearer by virtue of taking part in a conversation"(59).

Winograd emphasizes that:

1. he is concerned with the **structure**, not the content of the conversation
2. the acts are linguistic, representing utterances and silences between the requestor and hearer
3. conditions of satisfaction depend on the "interpretation of speaker and hearer"; they are not "objective realities"(66). See figure 5 below.

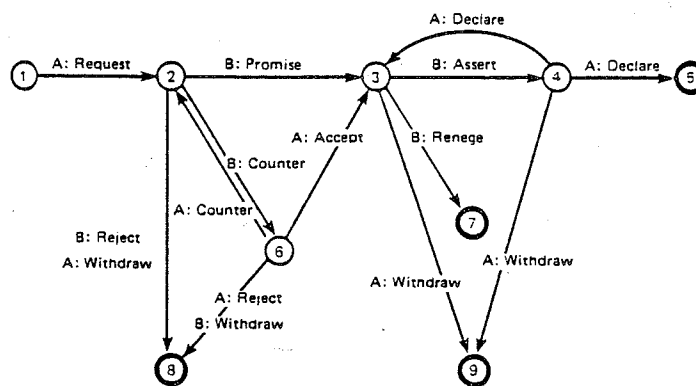


Figure 5. : The basic conversation for action

For example, Winograd correctly observes that "what is not said is listed to as much as what is said," and that some acts are taken for granted, if, for example, there is no declaration to the contrary"(66).

Some limitations of Winograd's model are as follows:

1. It identifies only **one** very limited type of human conversation-
-a "commissive," i.e., one that commits the speaker to an action
2. It does not take into account non-verbal elements, or such element as the environment and status as identified in the Targowski-Bowman model.
3. Most important, it does not acknowledge that language is primarily sound of the voice, of the words, of the tone, that creates and conveys meaning, that stimulates response.

Despite these limitations, Winograd's model is superior to any other I know of dyadic communication. The power of Winograd's model is its grounding in three salient truths:

1. Interpersonal communication is recursive in nature and can be analyzed in terms of cybernetics and the effect of feedback.
2. Human communication evolved from the need for survival, and the study of information processing in other animals using communication to survive can elucidate the process of information processing in human beings.
3. Meaning derives not merely from "a systematic manipulations of representations" (10), (as suggested by Mitchell and Lehnert, for example), but from the experience of individuals living and interacting with other individuals in a social environment, and within a culture and a tradition.

His model is based on the view that an understanding of communication and cognition requires solid understanding of living organisms as they function in their natural environment. Winograd's model is built on the solid foundation of a wholistic, systems approach to communication. Specifically, Winograd builds his model on Humberto Maturana's rigorous scientific studies of information processing in frogs. According to Winograd, "Maturana provides two useful insights... : the role of the observer in creating **phenomenal domains**; and the concept of **structural coupling**, which is to understand behaviour that is mechanically generated but not programmed" (10). Maturana's emphasis on **survival** (49) and on the ways in which organisms use language, actions, and behavior in response to their environment and in their interactions with other organisms from the perspective of a neurophysiologist elucidates information processing in human beings. His work "Neurophysiology of cognition"(1970) and "Biology of language: The epistemology of reality" (1979) have enormously important implications for the understanding of human communication.

The fact that Maturana illustrates his thesis with examples from mating rituals, and that Winograd builds on Maturana's description of "the mating dance as a pattern of mutual interactions" (49) serves to emphasize that successful communication and information processing is basic to the survival of all living species.

IV. CONCLUSION

Scholars and researchers from various disciplines have attempted to understand and represent graphically the process of human information processing and interpersonal communication. Models from business communication, information process in advertising, and AI research on memory access discussed in this paper contribute some insights for constructing a model, although no adequate model presently exists. The most promising model of those discussed here is the one by Winograd, who incorporates into it knowledge from cybernetics, as well as from neurophysiology and from semiotics.

A more complete, more perfect model of interpersonal communication would combine the best features of the Targowski-Bowman layered model (i.e., the influence of the physical medium used for the exchange; the attitudes of the speakers towards themselves and towards each other; and the effects of the time and place of the session on the outcome of the dialog) with the emphasis on **commitment** and on the structure of the interactions, as suggested by Winograd's model. Rather than the rigid, hierarchical layered model or the deliberately restricted domain of discourse described by Winograd, this more perfect model of dyadic communication would include more elements of observed behavior, represented graphically by feedback loops to suggest the non-linearity and the complexity of the process. Such a model, with the appropriate influence diagrams, is the subject of my next paper.

"A fundamental condition of successful communication," observes Winograd, is "a standing commitment by both speaker and listener to enter into dialog in the face of a breakdown"(63). It is only by a recursive process of interactions between the sender and receiver that organisms succeed in approaching each other's version of reality, for reality is neither entirely subjective nor entirely objective. "Reality" is negotiated when two individuals use feedback to "adjust their future conduct by past performance." And when **both** are committed to continue the dialog until they arrive at consensus. While they may not see the same tree, they have constructed, by their engaged conversation, some semblance of shared meaning. Perhaps, more importantly, they have affirmed or re-affirmed some bond of trust, thereby strengthening the social relationships on which all language and discourse are founded.

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