

THE COMPUTER AS AN ACTIVE COMMUNICATION MEDIUM

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1. THE NATURE OF COMMUNICATION

Communication is often conceived of in basically the following terms. A person has some idea which he or she wants to communicate to a second person. The first person translates that idea into some symbol system which is transmitted through some medium to the receiver. The receiver receives the transmission and translates it into some internal idea. Communication, in this view, is considered good to the extent that there is an isomorphism between the idea in the head of the sender before sending the message and the idea in the receiver's head after receiving the message. A good medium of communication, in this view, is one that adds minimal noise to the signal. Messages are considered good partly to the extent that they are unambiguous. This is, by and large, the view of many of the people concerned with computers and communication.

For a moment, consider a quite different view of communication. In this view, communication is basically a design-interpretation process. One person has goals that they believe can be aided by communicating. The person therefore designs a message which is intended to facilitate those goals. In most cases, the goal includes changing some cognitive structure in one or more other people's minds. Each receiver of a message however has his or her own goals in mind and a model of the world (including a model of the sender) and interprets the received message in light of that other world information and relative to the perceived goals of the sender. This view has been articulated further elsewhere [3].

This view originates primarily from putting the rules of language and the basic nature of human beings in perspective. The basic nature of human beings is that we are living organisms and our behavior is goal-directed. The rules of language are convenient but secondary. We can language rules for a purpose break.

Communicating in different media produces different behaviors and reactions [2, 3]. The interesting first order finding however, is that people *can* communicate using practically any medium that lets any signal through if motivation is high enough. We can, under some circumstances, communicate with people who use different accents, grammars, or even languages. Yet, in other circumstances, people who are ostensibly friends working on a common goal and who have known each other for years end up shouting at each other: 'You're not listening to me. No, you don't understand!'

One fundamental aspect of human communication then is that it is terrifically adaptive, and robust, containing a number of sophisticated mechanisms such as explanations that simultaneously facilitate social and work

goals [4] metacomments that direct the conversation [5], and rules for taking turns [6].

To the extent that these mechanisms can be embedded in a computer system that is to dialogue with humans, the dialogue will likely tend to be more successful. However, equally true of human communication is that it is sometimes quite ineffective. Let us examine where, why, and how the computer can help improve communication in those cases.

2. FUNDAMENTAL DIFFICULTIES IN COMMUNICATION

The view of communication as a design-interpretation process suggests that since messages are designed and interpreted to achieve goals, the perceived relationship between the goals of the communicators is likely to be a powerful determinant of what happens in communication. Common observation as well experimental results [1] are consistent with this notion. People often view themselves in situations of pure competition or pure cooperation. In fact, I suggest that either perception is due to a limited frame. Any two people who view themselves as involved in a zero-sum game are doing so because they have a limited frame of reference. In the widest possible frame of reference, there is at least one state probabilistically influenced by their acts (such as the total destruction of human life through nuclear weapons) that both would find undesirable. Therefore, when I am playing tennis, poker, or politics with someone and we say we are in pure competition, we are only doing so in a limited framework. In a wider framework, it is always in our mutual interest to cooperate under certain circumstances.

This does not mean, however, that people perceive this wider framework. Because of the limitations of human working memory, people often forget that there is a framework in which they can cooperate. Indeed, this describes one of the chief situations in which a so-called breakdown of communications occurs. If we are *truly* in a zero-sum game, communication is only useful to the extent that we mislead, threaten, etc.

Conversely, people are only in pure cooperation by limiting their framework. I suggest that it is highly likely, given any two individuals, that they would put a different preference ordering on the set of all possible states of the world which their actions could probabilistically affect. This gives rise to a second type of breakdown in communication. People appear to be desiring to cooperate but they are only cooperating with respect to some limited framework X. They are competing with respect to some larger framework X plus Y. The most common X plus Y is X, the framework of cooperation plus Y, a consideration of whose habits must change for mutually beneficial action in the framework X.

For instance, two tennis partners obviously both want to win the game. Yet one is used to playing with both partners attempting to take the net. The other is used to the 'one-up, one-back' strategy. They can get into a real argument. What they are competing about is basically who is going to change, whose opinion is wrong, and similar issues. This then, in a sense, is a second type of breakdown of communication.

A third case exists even within the framework of cooperation. This case of difficult communication exists when the presupposed conceptual frameworks of the communicators is vitally discrepant. A computer programmer really wants to help a business person automate his or her invoicing application and the business person really wants this to happen. However, each party erroneously presumes more shared knowledge and viewpoint than in fact exists.

A puzzle still remains however. If people have such sophisticated, graceful, robust communication mechanisms, why do they not quite readily and spontaneously overcome these communication blocks?

WIDESPREAD ANTI-PRODUCTIVE BELIEFS

The biggest stumbling blocks to effective communication are the individual communicator's beliefs. People typically hold beliefs which are not empirically based. To some extent, it is impossible not to. In order to simplify the world sufficiently to deal with it, we make generalizations. If it turns out on closer inspection that these generalizations are correct, we call it insight while if it turns out that they are incorrect, we call it overgeneralization.

There are, however, a number of specific non-empirically based beliefs that people are particularly likely to believe which are anti-productive to communication. Among these are the following: 1. I must be understood; 2. If the other person disagrees with me, they don't understand me; 3. My worth is equal to my performance; 4. Things should be easy; 5. The world must be fair; 6. If I have the feeling of knowing something is true, it must be true; 7. If the other person thinks my idea is wrong, the person thinks little of me; 8. If this person's idea is wrong, the person is worthless; 9. I don't need to change -- they do; 10. Since I already know I'm right, it is a waste of time to really try to see things from the other person's perspective. 11. If I comprehend something, in the sense that I can rephrase it in a syntactically different way, that means I have processed deeply enough what the other person is saying. 12. I must tell the truth at all times no matter what. 13. If they cannot put it in the form of an equation (or computer program, or complete sentences, or English), they don't really know what they are talking about and so it is not possibly in my interest to listen.

Each of the above statements, has a correlated, less rigid, less extreme statement that is empirically based. For instance, if we really thought 'When I am wrong, some people will temporarily value me less', that is a valid generalization. In contrast, the thought 'When I

am wrong, people will value me less' is an overgeneralization.

Similarly, it is quite reasonable to believe that expressing something mathematically has advantages and that if it is not expressed mathematically it may be more difficult for me to use the ideas; it may even be so difficult that I choose not to bother. It is not empirically based to believe that it is never worth you while to attempt to understand things not expressed in equations.

Nearly everyone, even quite psychotic people hold rational as well as irrational beliefs. Very few people when asked whether they have to be perfect in everything will say yes. However, very many people reject so completely evidence that they may be fundamentally wrong, that they act as though they must be perfect. It is bitter irony that most people can think and feel much more clearly about the things that are less important to them such as a crossword puzzle than they can about things that are much more important such as their major decisions in work and love.

Now let us imagine someone who has done a certain office procedure a certain way for many years. Then someone begins to explain a new procedure that is claimed to work better. There are a number of wholly rational reasons why the experienced office worker can be skeptical. But it is probably quite worthwhile to at least attempt to really understand the other person's ideas before criticizing them. There are many non-empirically based beliefs that may interfere in the communication process. The experienced office worker may, for instance, notice the young age of the systems analyst and believe that no-one so young could really understand what is going on. They may believe that if there is a better way, they should have seen it themselves years ago and if they didn't they must be an idiot. Since they didn't see it and they can't be an idiot, there must not be a better way. They may just think to themselves it will be too hard to learn a new way. Very effective individual therapy [7] is based on trying to identify and change an individual's irrational beliefs. The focus of this paper however is on how a computer system could aid communication by overcoming or circumventing such irrational beliefs in those cases where communication appears to break down.

We know that people are capable of changing from a narrow competition framework to a wider cooperative framework in order to communicate. People can resolve differences about whose behavior needs to change. Normal communication has the mechanisms to do these things; when they fail to happen it is often because of irrational beliefs which prevent people from attempting to see things from the other person's perspective.

The tennis partner's disagreeing about what strategy to use will tend to resolve the disagreement without detriment to their mutual goal of winning the game, provided their thinking stays fairly close to the empirical level. If, however, one of the participants finds a

flaw in the other's thinking and then overgeneralizes and thinks 'What an idiot. That doesn't logically follow. How can anyone be so dumb.' But by the token 'dumb', the angry person probably means 'all-around bad.' Now this is an extremely counter-productive overgeneralization which will tend to color the person's thinking on other issues of the game which are not even within the scope of the argument about what strategy to use. In extremely irrational but not so uncommon cases, the person may even express to the other person verbally or non-verbally that they have a generally low opinion of their partner. If either party becomes angry, they are also likely to mix up their messages about their own internal state with messages about the content of the game. Thus, 'I am angry,' gets mixed with 'A serve to that person's backhand will probably produce a weaker return.' The result may be a statement like 'Why can't you serve to his backhand for a change.' Such a statement is likely to increase the probability of serves to the forehand or double faults to the backhand.

Once each person becomes angry with the other, they are almost certainly overgeneralizing to the extent that they are believing that the only way to improve the situation is for the other person to change their behavior in some way 'He should apologize to me for being such an idiot.' No active problem solving behavior remains directed where it belongs: 'How can I improve the situation myself? How can I communicate better?' This is communication breakdown.

4. THE POSSIBLE USES OF AN ACTIVE COMMUNICATION CHANNEL

Now, let's just for the sake of argument, *assume* or if you like *pretend* that what I have said so far is a useful perspective. What about the computer? In particular, what about using the power of the computer as a non-transparent ACTIVE medium of communication? The computer has been very successfully used as a way for people to communicate which allows speed/repetition and demands precision. Is there also a way for the computer to be used to enhance party-to-party communication in a way that helps defeat or get around the self-defeating beliefs that get in the way of effective communication in situations where participants have similar goals but are working in different frameworks? Can the computer aid in situations where participants have partially similar goals but are concentrating on the differences...or are unable to arrive at conclusions that are in both parties self-interest because of interference from a set of separate issues where they are in fundamental conflict?

An entire technology equal to the one that has addressed the speed/repetition precision issues could be built around this task. Clearly I cannot provide this technology myself in fifteen minutes or fifteen years. But let me provide one example of the *kind* of thing I mean. Suppose that one two people were disagreeing and communicating via Visual Display Terminals connected to a computer network. Let us suppose that the computer network imposed a formalism on the communication. Suppose, for example that strength

and directionality of current emotional state were encoded on a spatially separate channel from content messages. Imagine that the designer of the message had to choose what emotion or emotions they felt and attempt to honestly quantify these. This information would be presented to the other person separately from the content statements. One unfortunate human weakness would be overcome; viz., the tendency to let the emotional statement -- 'I am angry' intrude into the content of what is said.

Now, suppose the computer network presented to the interpreter of this message a set of signals labelled as follows: 'The person sending this message to you is currently producing the following emotional states in themselves: Anger +7, Anxiety +4, Hurt +3, Depression +2, Gladness -6.' Note that the attribution has also been shifted squarely to where it belongs -- on the person with the emotional state.

Now suppose further that when a person stated their position, certain key words triggered a request by the system for restatement. For instance, suppose a person typed in 'You always get what you want.' The system may respond with: 'Regarding the word 'always', could you be more quantitative. First, in how many instances during the last two weeks would you estimate that there have been occasions when that person would like to have gotten something but could not get that thing?'

Unfortunately, asked just such a question, an angry person would probably become angrier and direct some anger toward the active channel itself. A marriage counselor is often caught in just this sort of bind, but can usually avoid escalating anger via empathy and other natural mechanisms. How a computerized system could avoid increasing anger remains a challenge.

Another possibility would be for the channel to enforce the protocol for conflict resolution suggested by Rapaport and others. For instance, before stating your position, you would have to restate your opponent's position to their satisfaction.

Needless to say, participants using such an active interface would be apprized of the fact and voluntarily choose to use such an interface for their anticipated mutual benefit in the same way that labor and management often agree to use a mediator or arbitrator to help them reach an equitable solution. Unfortunately, such a choice requires that both the people involved recognize that they are not perfect -- that their communication ability could use an active channel. This in itself presupposes some dismissal of the erroneous belief that their worth EQUALS their performance. Most people are capable of doing this before they become emotionally upset and hence might well agree ahead of time to using such a channel.

5. SUMMARY

In this paper, I reiterate the view that for many purposes, communication is best conceived of as a

design-interpretation process rather than a sender-receiver process. Fundamental difficulties in two-person communication occur in certain common situations. The incidence, exacerbation, and failure to solve such communication problems by the parties themselves can largely be traced to the high frequency of strongly held anti-empirical belief systems. Finally, it is suggested that the computer is a medium for humans to communicate with each other VIA. Viewed in this way, possibilities exist for the computer to become an *active* and *selective* rather than a *passive, transparent* medium. This could aid humans in overcoming or circumventing communication blocking irrational beliefs in order to facilitate cooperative problem solving.

6. REFERENCES

- [1] Thomas, J. A Design-Interpretation Analysis of Natural English. *International Journal of Man-Machine Studies*, 1978, 10, 651-668.
- [2] Carey, J. A Primer on Interactive Television, *Journal of the University Film Association*, 1978, XXX (2), 35-39.
- [3] Chapanis, A. Interactive Human Communication: Some Lessons Learned from Laboratory Experiments. Paper presented at NATO Advanced Study Institute on 'Man-Computer Interaction', Mati, Greece, 1976.
- [4] Wynn, E. Office Conversation as an Information Medium. (In preparation).
- [5] Thomas, J. A Method for Studying Natural Language Dialogue, *IBM Research Report*, 1976, RC-5882.
- [6] Sacks, H., Schlegloff, E., and Jefferson, G. A Simplest Systematics for the Organization of Turn-taking for Conversation, *Language*, 1974, 50 (4), 696-735.
- [7] Ellis, A. *Reason and Emotion in Psychotherapy*. New York: Lyle Stuart, (1962).