HUMAN COMMUNICATION: WHAT HAPPENS?

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Abstract: The development of information technology opens up new venues of human communication. So far, most research has been devoted to the technological side of communication. By analysing the metaphors that are used to talk about communication, the differences between technological and human communication can be targetted. What is needed in order to understand human communication is more knowledge about the contents of what is communicated, not only the coding. Cognitive semantics offers a promising way to analyse how linguistic information is connected with perception and memory. But we should also consider what cognitive processes are involved in dialogues between people in order to further develop the forms of human communication with and via computers.

1. TWO KINDS OF INFORMATION

Information exists in two worlds. One is that of telegraphs, telephones, and computers. The other world is that of humans. We generally take it for granted that it is the same kind of information in both worlds, but this is far from obvious. For the world of artifacts there is a well established theory of

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communication formulated by Claude Shannon in the late 1940s [9]. He defined a way of measuring the *amount* of information that is communicated through a channel. His theory has been very successful and is dominating in the technological world. With the advent of personal computers, very many people are now familiar with notions such as "bit" and "baud", even though they are not in general aware of the theoretical background.

It has been taken for granted that the theory that is valid of a telephone line also holds of human communication. But the two types of information should not be confused – human information does not come in bits. Hence, we need a different theory for human communication. The purpose of this article is to formulate some requirements for such a theory and to point out some potential applications.

People are tremendously effective at processing information. Our senses and our language abundantly provide us with enormous amounts of information that we normally have no problem interpreting. Furthermore, we can simultaneously handle several information codes and translate between them without even noticing it. For example, first–graders have no problem with describing the content of a picture in a magazine or drawing a picture that illustrates a story. With little effort, we can convert information from pictures to words and back again. Within this context, one can ask whether it is possible to get computers to do the same thing.

Within modern computer technology, in particular within the area of multimedia, people handle different information codes in parallel. On a computer screen, people can simultaneously be presented with a text document, graphics that complement the text, a film that illustrates the text, and sound that accompanies the film. The multimedia programs provide the user with a great amount of information much like the videos shown on MTV. However, it is the *user* that gets to make the relevant connections and structure the information from the different media. This often presents a cognitive problem because the largest portion of the perception process consists of *filtering out* irrelevant information rather than absorbing as much information as possible.

What is information for a computer can be meaningless for a human. For example, I often use Internet to retrieve files for documents and pictures. The files for pictures are coded in a particular format (TIFF, PICT, etc). I

can view the files in this format, but this form of information is completely inaccessible for a human. However, if I print the files, the file is transformed into a picture that is immediately understandable for me.

According to Shannon's theory of information, both the file and the printed picture contains the same information – one format can be translated to the other, and *vice versa*, without any loss of information. However, for a human, the two formats are obviously not equivalent. Hence the problem of human information processing is not a problem of obtaining sufficient amounts of information, but rather to receive information in a *form* that is suitable for our cognitive capacities.

2. TWO METAPHORS OF INFORMATION

Now, if human information is not the same as the technological notion, *what* is it then? One way of attacking this question is to study the *metaphors* we use when talking about information. In a classical paper on "The conduit metaphor," the linguist Michael Reddy [8] shows that our way of talking about information is tightly connected to Shannon's theory of information. We are "sending" messages to somebody who "receives" them. We have "channels" to different people. Sometimes the messages are "full" of meaning, but often they are "hollow." Ideas can "come through" to us. But is this way of speaking really metaphorical? Is it not the way information *really* functions?

To see that it is a metaphor, one can contrast it with other ways of describing communication. An alternative way of describing information is to say that communicating is to establish a state of *resonance* between the two partners. One can then say that the listener is in "harmony" with the speaker and "resonates". The responses from the listener "reinforces" the communications. The original meaning of "communicare" in Latin is "to make common."

Neither of the two metaphors for information has a monopoly on truth. Different metaphors are more or less suitable for different purposes. They provide us with different *perspectives* on information and communication. No perspective provides a complete picture of reality, but different

perspectives can complement each other and bring out the deficiencies of other metaphors.

The conduit metaphor implies that one can *store* information in libraries and in computers. However, according to the resonance metaphor, the information does not exist of itself in books or on diskettes, but emerges only when somebody can resonate with the material. As Bateson observes information, like probability, is of *zero dimensions*. He says: "It is flatly obvious that no variable of zero dimensions can be truly located." [1, p. 414]. According to the resonance metaphor, it is thus misleading to say that computers *process* information. Without *interpretation*, such media only contain physical tokens.

It is a myth, which is tied to the conduit metaphor and is emphasized by all the talk about *cyberspace* and *infobahns*, that more information is always better. The real information first appears when the user *interprets* the stream of bits. The human brain is not like a hard disk that passively accepts the flow of information. The greater the amount of bits that are let through, the more the user needs to struggle to keep up and make sense of a message. *Narrow* channels that have intelligently sifted through the stream of bits would be of greater help for the human user than information highways where everything rushes indiscriminately by.

The most important difference between the technical sense of information and the human is that, for a human, the information only exists when he or she *interprets* the sound waves, the sequence of letters, or the stream of bits. Interpretation consists of sifting through the message and making it resonate with earlier experiences and knowledge. On this perspective, the listener is no longer a passive "receiver" of a ready-packed message, but is *actively* taking part in creating the information. The more similar experiences and background the two communicators have, the less they need to say in order to establish a resonance. Under certain circumstances, *no message at all* needs to be sent in order for information to be communicated. For example, consider what happens if you don't send your income tax form to the authorities! (This example is due to Bateson [1, p. 458]).

3. FOUR STAGES OF HUMAN–COMPUTER-INTERACTION

With these differences between the two kinds of information in mind, let us now have a look at how humans and computers communicate. One can say that, so far, this kind of communication has gone through three phases. The first of these is the phase of *the magic formula* where the user provided cryptic commands in a secret language to the machine. The slightest spelling error was punished by a complete break down in communication. The second phase, which still is dominating, is on the level of *point–and–say* books. One can point to pictures (icons), and by clicking on them, one can get new pages to click on. With the help of speech recognition, the third phase is becoming one of *military commands*. By giving the computer short bursts of commands, it will be able to carry out some of the operations of which it is capable. At this point, however, the computer is completely insensitive – a flattering or angry tone of voice can in no way change what happens.

Commands are really not a very advanced form of communication. A future fourth phase should be based on human *dialogue*. A true dialogue assumes that the person (or artifact) being addressed can interject comments, objections and further questions. Within the computer world such abilities are, as yet, missing, even though there are some computer games that make a primitive attempt at this.

4. COMMUNICATION AND UNDERSTANDING

There is no established theory of human communication that corresponds to Shannon's theory. What comes closest is the analysis of *meaning* put forward by the philosopher Paul Grice [3]. He emphasizes that *team-work* and *feedback* are necessary for a meaningful communication. Thus his theory fits better with the resonance metaphor of information.

For example, if I am trying to inform my friend of something, it is not sufficient that I say it. I must also know that she understands what I am saying and that I believe that she believes that I am speaking sincerely and not just pulling her leg. This results in complicated patterns like "I believe

that she believes that I mean what I am saying." *Irony* is one level more difficult since it presumes something like "I believe that she does *not* believe that I mean what I am saying." Just imagine having a computer program becoming involved in such a mirroring game. A computer very seldom believes anything, let alone believes anything about what you believe. Hence, it will be a while before we will have computers that can understand ironical comments.

However, with some progress in the research on dialogues, we can, for example, look forward to word processing programs that offer smart stylistic and content related advice about the text that one is writing. But we will not get anything that can match the time trusted secretary until the computer *understands* the written text.

Understanding a text involves the ability to make the connection between it and what the words mean. One of the assumptions in so called *cognitive semantics*, is that the meaning of words is closely connected to the information that we get through *perception* and *memory* [2], [5]. Additionally, this information can be represented in the form of *image schemas*. This theory is developed by Lakoff [6] and Langacker [7] and others, and computational aspects of implementing the schemas have been investigated by Holmqvist [4].

In this theory, the meaning of a word consists of a sort of code that is related to the image code. The understanding of a text is achieved by combining the image schemas produced by the words in the text and then by putting them together in an internal scene. The result is a *performance,* in the theatrical sense, of what the text is about.

5. INTERMEDIA

The fact that the images schemas of cognitive semantics connect language to perception emphasizes my earlier point that humans are stunningly good at shifting between different codes of information. Imagine having programs that could translate between different media! One example would be a program that could automatically produce an illustration of a written story. Another hypothetical product is a gadget that could read street signs, or the

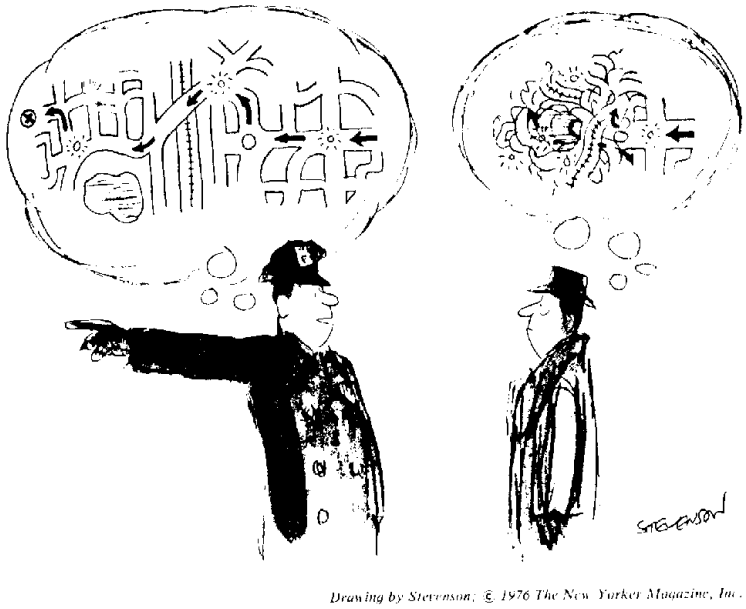
text on the cans in the grocery store, for the blind. I will coin the concept *intermedia* to refer to programs that can interpret and establish connections between different information codes. In order to create order in the overflow of information that modern technology offers, we need intermedia rather than multimedia.

Figure 1: Intermedia

For certain special applications, intermedia already exists. Programs for synthetic speech can convert a given text to sounds that impressively resemble human speech. Many of the large computer companies are working on the opposite problem of converting sound to text, primarily in order to allow computers to accept spoken commands. As long as one uses the vocabulary that the operating system requires, it works quite well. There are also commercially available programs with the help of which one can dictate a letter or an article and have the text written out directly by the computer.

What above all remains to be developed are programs for a more general ability that can translate between images and words. Obviously one cannot literally "translate" an image into words – there are always aspects of an image that cannot be captured in words. This is also true in reverse: for a given text, it is not simply the case that *one* image can be created that has the same content as the words. We humans, however, can easily translate information from one code to the other. But we hardly have any knowledge

about *how* we do it, in any case not on a level that can be exploited for developing intermedia programs. The fundamental problem is that we do not particularly know that much about how images are treated in our heads.



Drawing by Stevenson; © 1976 The New Yorker Magazine, Inc.

Figure 2: Translating from pictures to words – and back again.

Take an apparently simple problem like placing a name with a face. How does one describe for the computer the relevant features that allow one to recognize a face, even after several decades? In solving this problem, the experience of artists and passport control personnel may be of greater importance than the current methods used by image processing engineers.

Hence, intermedia requires fundamentally basic research regarding human cognitive processes. Modern information technology has been dominated by methods for transferring information between computers and other machines. The most interesting direction in the transfer of information is, nevertheless, the link between humans and machines, let alone the link between humans themselves.

6. APPLICATIONS FOR THE DISABLED

For the icing on the cake, research regarding intermedia can provide us with further aid for *handicapped* individuals. The deaf and blind are each lacking

a medium. Through intermedia, these sensory deficits can hopefully be aided. If we achieve better programs for speech recognition for example, deafness can be partly compensated for. But it is far from obvious that the written word is the best way of representing speech to the deaf. Text loses much in the way of emphasis, rhythm and breaks that make spoken language a lot richer than written language. In addition to translating spoken sound, it may also be beneficial to translate words into colors and forms and to present these modes to the deaf as well.

Currently, the blind have some tools to aid them in converting written text to a tactile form which can be read off with the tips of their fingers. Using this method, they can read newspapers or instruction manuals. The problem of converting images into tactile form, however, remains. It is not only a technical problem to convert pictures to tactile presentations – here we already have some forms of technology, even if much remains to be done. A more fundamental problem, and one that requires much more research within cognitive science, is the question of what *aspects* of a picture should be given tactile representation. For example, should the visual *texture* of an object be represented in a tactile form or would the *contours* of the object be sufficient?

7. CO-OPERATION BETWEEN FACULTIES

In various forms, intermedia is well on its way and will lead to a revolution within many areas. One central requirement leading to the development of new kinds of intermedia is *more knowledge* about how humans process information. Above all, we must focus on research regarding how we interpret images and convert them into language.

For once, research concerning human abilities can provide us with the possibility of quick technological applications. Put together researchers from the humanities with people from psychology, cognitive science and the technological areas so that they will be forced to break down the traditional walls that have separated them in the past! The human faculties co-operate without significant problems, and the same should apply to the university faculties.

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