

NATURAL LANGUAGE AND COMPUTER INTERFACE DESIGN

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SOME ICONOCLASTIC ASSERTIONS

Considering the problems we have in communicating with other humans using natural language, it is not clear that we want to recreate these problems in dealing with the computer. While there is some evidence that natural language is useful in communications among humans, there is also considerable evidence that it is neither perfect nor ideal. Natural language is wordy (redundant) and imprecise. Most human groups who have a need to communicate quickly and accurately tend to develop a rather well specified subset of natural language that is highly coded and precise in nature. Pilots and police are good examples of this. Even working groups within a field or discipline tend over time to develop a jargon that minimizes the effort of communication and clarifies shared precise meanings.

It is not clear that there is any group of humans or applications for computers that would be better served in the long run by natural language interfaces. One could provide such an interface for the purpose of accimating a group or individual to a computer or information system environment but over the long run it would be highly inefficient for a human to continue to use such an interface and would in a real sense be a disservice to the user. Those retrieval systems that allow natural language like queries tend to also allow the user to discover with practice the embedded interface that allows very terse and concise requests to be made of the system. Take the general example of COBOL, which was designed as a language to input business oriented programs into a computer that could be understood by non-computer types. We find that if we don't demand that programmers follow certain standards to make this possible, they will make their programs cryptic to the point where it is not understandable to anyone but other programmers.

It is interesting to observe that successful interfaces between persons and machines tend to be based upon one or the other of the two extreme choices one can make in designing a language. One is small, well defined vocabularies from which one can build rather long and complex expressions and the other is large vocabularies with short expressions. In some sense, "natural language" is the result of a compromise between these two opposing extremes. If we had some better understanding of the cognitive dynamics that shape and evolve natural language, perhaps the one useful natural language interface that might be developed would allow individuals and groups to shape their own personalized interface to a computer or information system. I am quite sure that given such a powerful capability, what a group of users would end up with would be very far from a natural language.

The argument is sometimes made that a natural language interface might be useful for those who are linguistically disadvantaged. It might allow very young children or deaf persons to better utilize the computer. I see it as immoral to provide a natural language introduction to computers to people who might mistakenly come to think of a computer as they would another human being. I would much prefer such individuals to be introduced to the computer with an interface that will give them some appreciation for the nature of the machine. For example, a very simple CAI language called PILOT has been used to teach grammar school children how to write simple lessons for their classmates. The ability of the young children to write simple question

answer sequences and then see them executed as if the computer was able to use natural language is, I believe, far more beneficial to the child than giving him canned lessons as his or her first impression of what a computer is like.

COMPUTERIZED CONFERENCING

Since 1973 at the New Jersey Institute of Technology, we have been developing and evaluating the use of a computer as a direct aid to facilitating human communication. The basic idea is to use the processing and logical capabilities of the computer to aid in the communication and exchange of written text (Hiltz & Turoff, 1978). As part of this program we have been operating the Electronic Information Exchange System (EIES) as a source of field trial data and as a laboratory for controlled experimentation. Currently, EIES has approximately 600 active users internationally. Our current rate of operation is about 5,000 user hours a month; 8,000 messages, conference comments and notebook pages written a month and about 35,000 delivered each month. The average message is about 10 lines of text and the average comment or page is about 20 lines of text.

EIES offers the user a complete set of differing interfaces including menus, commands, self-defined commands and self programming of interfaces for individuals and groups. In addition to the standard message, conference and notebook features, EIES has been designed with the incorporation of a computer language called "INTERACT" that allows special communication structures and data structures to be integrated into the application of any specific group. Much of this capability has evolved since 1976 through a numerous set of alternative feedback and evaluation mechanisms. Our users include scientists, engineers, managers, secretaries, teenagers, students, Cerebral Palsy children and 80 year old senior citizens. In all this experience we have yet to hear a direct request or even implicit desire for any sort of natural language like interface.

To the contrary, we have indirect empirical data that supports the premise that a natural language like interface would be a disadvantage. For the most part, the behavior of users on EIES is very sensitive to the degree of experience they have had with the system. However, there is one key parameter which is insensitive to the degree of experience or the rate of use of the system. This is the number of items a user receives when he or she sits down at the terminal to use the system. This number stays at around 7 plus or minus 2. This is obviously a prescriptive effect the system has on the user as they get into the habit of signing on often enough so that they will not have more than around 7 new text items waiting for them. Users who have been cut off for a long period by a broken terminal or a vacation that denies them access usually give out textual screams of "information overload" when they find tons of text items waiting for them. In a real sense, it is natural language that is generating this information overload for the user. Another pertinent observation is that each user has three unique identifiers; a full name, a short nickname, and a three digit number. Some users always use nicknames and some always use numbers to address their messages but I have yet to encounter anyone who uses full names on a regular basis.

AUTOMATED ABSTRACTING

Our observations do point to one application where the ability to process natural language would be a significant augmentation of the users of computerized conferencing systems. We have a large number of conferences that have been going on for over a year and which contain thousands of comments. While a person entering such an on-going discussion can, in principle, go back and read the entire transcript or do selective retrieval on subtopics, it would be far preferable to be able to generate automatic summaries of such large text files. Even for regular use, the ability to get automated summaries would significantly raise the threshold of information overload and allow users to increase their level of communication activity and the amount of information with which they can deal meaningfully.

The goal of being able to process natural language has always been a bit of a siren's call and has a certain note of purity about it. Those striving for it sometimes lose sight of the fact that an imperfect system may still be quite useful when the perfect system may be unobtainable for some time. One of the important problems well recognized in the computer field is teaching computers how to "forget" or eliminate garbage. A less well recognized problem is the one of teaching a computer how to "give up" gracefully and go to a human to get help. In other words, the natural language systems that may have significant payoff in the next decade are those that blend the best talents of man and machine into one working unit.

In the computerized conferencing environment, this means that a person requesting a summary of a long conference probably knows enough about the substance to guide the computer in the process and to tailor the summary to particular needs and interests. In computerized conferencing, the ultimate goal is "collective intelligence" and one hopes that the appropriate design of a communication structure will allow a group of humans to pool their intelligence into something greater than any of its parts. If there is an automated or artificial intelligence system, then providing that system as a tool to a group of humans as an integral part of their group communication structure, the resulting intelligence of the group should be greater than the automated system alone. I believe a similar observation holds for the processing of natural language. Too often those working in natural language seem to feel that integrating humans into the analysis process would be an impurity or contaminant. In fact, it may be the higher goal than mere automation.

WRITING STYLE

A related area with respect to computerized conferencing is the observation that the style of writing in this medium of communication differs from other uses of the written or spoken version of natural language. First of all, there is a strong tendency to be concise and to outline complex discussions. We can observe this directly in the field trials and also observe that users bring group pressure upon those who start to write verbose items or items off the subject of interest to the group. The mechanism most commonly employed is the anonymous message. Also, in our controlled experiments on human problem solving (Hiltz, et al., 1980) we have found that there is no difference in the quality of a solution reached in a face-to-face environment or in a computerized conferencing environment. However, we do observe that the computerized conferencing groups use approximately 60% fewer words to do just as good a job as the face-to-face groups. Using Bales Interaction Process Analyses (content analyses), we have also confirmed significant differences in the content of the communications.

New users go through a learning period in which it may take 10 to 20 hours to feel comfortable in writing in conferences. We feel this is due to the subconscious recognition that people write differently in this medium than in letters, memos or other forms of the written language. The majority of what a new user writes (95%) will be messages the first five hours of usage and it takes about 100 hours until 25% of their writings are in conferences. Also, it is about 100 hours before they feel comfortable in writing larger text items in notebooks. One other aspect in the style change is the incorporation of many non-verbal cues into written form (HA! HA!, for example). One cannot see the nod of the head or hear a gentle laugh. Another aspect of natural language processing that can aid users in this form of communications is help in overcoming learning curves of this sort by being able to process the text of a group and provide a comparative analysis to new members of a group so they can more quickly learn the style of the group and feel comfortable in communicating with the group. One can carry this farther and ask for abilities to deal in certain levels of emotion such as: I would like to make my statement sound more assertive.

CONCLUSION

I do believe that this form of human communication will become as widespread and as significant as the phone has been to our society. The future application of natural language processing really lies in this area; however, it is not in the interface to the computer that this future rests but rather on the ability of this field to provide humans direct aids in processing the text found in their communications. Perhaps the real subject to address is not the one with which this panel was titled but the problems of person-machine interface to natural language processing systems. Or, better yet, person-machine integration within natural language processing. The computer processing of natural language needs to become the tool of the writer, editor, translator and reader. It also has to aid us in improving our ability to communicate. Most organizations are run on communications and the lore that is contained in those communications. With the increasing use of computers as communication devices, the qualitative information upon which we depend becomes as available for processing as the quantitative has been.

Reference:

THE NETWORK NATION: Human Communication Via Computer, Starr Roxanne Hiltz and Murray Turoff, Addison-Wesley Advanced Book Program, 1978.

FACE TO FACE VS. COMPUTERIZED CONFERENCING: A controlled Experiment, Hiltz, Johnson, Aronovitch and Turoff, Report of the Computerized Conferencing and Communications Center, NJIT, January 1980.