

## DISCUSSION ON PAPER 1

DR. HIRSCHBERG set out to define the term 'heuristic' which appears in several papers. Although a computer can only carry out a perfectly defined program, in some cases the exact algorithm to be used is not known. In this case one can provide a number of alternative algorithms and a decision rule. The same procedure can be repeated with the decision rule itself.

More specifically, we may often be faced with the problem of finding that member of a large set which has a certain property. There may be categorical rules which can be used to limit the area of search, but even with these rules, the remaining elements that must be exhaustively searched may be too large to handle. We can then order these remaining possibilities, so that the search is shortened. This, in Dr. Hirschberg's opinion, is the essence of heuristics - the ordering of a set of possibilities.

Some of our linguistic knowledge is not of a categorical character. It cannot be used to limit the area of search, but it can be used for ordering purposes.

DR. YNGVE said that the number of words needed to test the author's procedure depends on the intelligence of the program. There is a lower limit, which is the number of words a child needs to hear in order to learn the language.

DR. GARVIN agreed with the point about a child's learning. It was perhaps a good idea to use a limited language in the early stages; a set of children's books, for example.

In some traditional linguistic methods, an informant is asked "can such a sequence of words occur" and if he says "no" this is accepted as a fact. With a computer processing text, no matter how much text is used one can never be certain that the absence of a certain combination ensures its impossibility.

DR. YNGVE then asked about the relevance of this to machine translation.

DR. GARVIN replied that this was not machine translation or applied language analysis, but a computational method applied to linguistics. It may produce linguistic facts usable in machine translation.

DR. YNGVE stated that the paper was relevant, in his view.

DR. RUBENSTEIN referred to his work published in "Language" - on the distribution of word classes in sentences of various lengths. In 1955 he had done a statistical investigation, unpublished, which showed that, in

English, the context more than two words in advance gives very little information about the class of a given word. This work now seemed to have a *raison d'etre*, and it showed that apparently useless information could become useful.

DR. EDMUNDSON pointed out that the statistician can help in the formulation of a problem. He should be called in before the data is collected to help design the experiment.

DR. GARVIN added that a real statistician was needed. If a computer can be used to analyse language on a large scale, the results could be applied not only to M.T. but also to information retrieval, automatic abstracting or even advertising.

PROF. LAMB presented some of the uses of automatic language analysis. Languages outnumber linguists at least two to one, and most of them have only rudimentary descriptions at present. There are writings in languages as yet undeciphered. Automatic language analysis can be applied to these problems. Finally, people are listening for messages from intelligent beings in outer space.

DR. GARVIN ended with a note of caution. It will take some time before results are obtained. The present programme has some restrictions. Firstly it presupposes that the data are segmented into meaningful pieces (in this case English words separated by spaces). Secondly it deals with languages not having extensive inflectional paradigms. For Russian, it is possible that a different program will be needed.

It will be some time before this subject gets beyond the stage of testing basic ideas. We can begin then to think about its application to different types of language.

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