

The Feasibility of High Quality Machine Translation

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This brief memorandum is intended as a contribution to the project entitled "Theoretical Study Effort of High Quality Translation" being conducted at the Linguistics Research Center (LRC) under Contract F30602-70-C-0129. It is a simple restatement of views expressed during formal and informal discussions in which I have taken part at LRC in September and October 1970.

The aim of the project is to evaluate the developments that have taken place in linguistics and computer science in the last five or six years in relation to the feasibility of fully automatic high quality translation (FAHQT). Not having any specialist knowledge of computer hardware or software, I will confine myself to the linguistic aspects of the problem. I would, however, point out that the doubts expressed by such scholars as Bar-Hillel about the feasibility of FAHQT in the early part of the 1960's had very little to do with the speed of operation and capacity of computers that were available at the time. Their critical attitude towards the feasibility of FAHQT was determined far more by their increased appreciation of the theoretical complexity (and perhaps ultimate impossibility) of specifying algorithmic procedures for syntactic analysis and for the resolution of semantic ambiguities. Advances made

in computer capabilities over the last decade would not therefore seem to be very relevant to an appraisal of the validity of their statements in the light of present knowledge (Advances in computer capabilities may of course be relevant to the pursuit of some less ambitious system of MT, to which I refer below.)

Let me begin by making the obvious point that "feasibility" presupposes "possibility." Is FAHQT even possible? This question cannot be answered without first deciding what "high quality" means in this context. Not even the most competent human translators can be relied upon to produce a "perfect" translation of any text submitted to them. Moreover, it is arguable that in certain styles or certain subjects of discourse "perfect" translation is impossible in principle. A fortiori, it is not feasible. The point I have just made would be accepted by some linguists and rejected by others; and I am conscious of the fact that my attitude is here in conflict with that of many semanticists, whose work over the last few years has been inspired by their commitment to the possibility of describing the semantic structure of all languages in terms of a set of universal semantic "features" (or "atomic concepts"). I give it as my opinion that, at the present time, the predispositions of certain scholars in favour of universal semantics are methodological or philosophical in character, and cannot yet be justified by any convincing appeal to empirical evidence. The fact that many influential linguists have adopted the "universalist" position in recent years is, I believe, irrelevant to our reappraisal of the feasibility of MT.

Bar-Hillel has recently drawn attention to the necessity of making the notion of "quality" relative to the purpose for

which a translation is intended. I would endorse his pragmatic attitude to this question; and I would make two further comments in the same pragmatic spirit. One kind of "quality" (in a translation system, rather than in a translation) might relate to the range, in style and content, of the material for which the system is designed. It would be my assumption that any MT system that is really intended to be at all viable will deliberately restrict the range of the input that it will accept. It may be impossible to specify any lexical item (or any particular sense of a lexical item) or any construction such that one can be certain it will never occur in "scientific English" (or whatever the source language is). But some restriction of style and content is essential.

A second kind of "quality" might relate to the incidence of failures to translate or of mistranslations. The difficulty of foreseeing all possible cases of this kind and of programming for the recognition of contextual cues to the resolution of ambiguity (granted that the text will always contain determin-able cues) was one of the principal difficulties referred to • by Bar-Hillel and other critics of FAHQT in the early 1960's. None of the recent work in syntax and semantics would lead me to believe that the prospects for FAHQT have in this respect improved. At the present time, it would seem to be impossible to design an MT system that is absolutely "fail-safe"; and it may very well be the case that this goal will never be achieved. Just how serious a problem this is in practice can hardly be decided on theoretical grounds. It may be that texts of the kind that are to be translated by the system can be assumed to contain not more than a tolerable number of phrases and sentences that are bound to be left untranslated or (what is more serious) wrongly translated. I have no opinion on this question.

Neither of the two points I have just made is of course original. I am concerned merely to reaffirm their continued validity.

Let me now turn to the more specific questions raised by the present "feasibility" study. Much of the earlier work in the field of MT was based on a totally inadequate conception of grammar. Considerable advances in syntax have undoubtedly been made over the last decade. It is therefore reasonable to enquire whether the models of syntax that have been proposed recently provide any surer basis for MT than did the earlier, now obsolete, models. In one sense, the answer to this question must be positive. By this statement I do not intend to imply that there is now some possibility of an algorithmic determination of the syntactic structure of input sentences, although there appeared to be no such possibility before. I do not believe that the situation has changed very much in this respect. What I mean is simply that linguists designing computational procedures for syntactic analysis now have a better idea of the range of phenomena that they need to take account of than they had a decade or so ago. Much of the current work in syntax, however, would seem to be irrelevant to the problems confronting MT-workers. For example, it is difficult to see how a decision for or against the "lexicalist" position could have any implications for the design of an MT system. Nor is it obvious, in general, that a model of grammar that has been proposed by linguists without reference to the problems of translation and the practicalities of computation should be the best model for MT. We are, in any case, as far from agreement about the formalization of grammar as we ever were, and we may even be further.

One of the more striking developments in linguistics in the last few years has been the increased attention given to

semantics and, more particularly, to the integration of semantics with syntax. Once again, it must be asserted, on any objective assessment of the current state of semantic theory, that such progress as has been made in this field seems to be almost totally irrelevant to the practical problems of MT. I have already alluded to the question of universal semantic "features" (and my own scepticism on this score). This is but one of the many points of controversy among semanticists at the present time. Others have to do with the degree to which the non-occurrence or abnormality of certain combinations of lexical items is a function of the meaning of those lexical items and the degree to which it depends upon the belief-systems of speakers of the language. In the case of both of these questions (and of a number of others that are currently being discussed), decisions we might come to independently of computational considerations seem to me to carry no implications at all for the design of a working MT system. It might well be that "real world" information relevant to the resolution of certain foreseeable ambiguities in the source language would be more conveniently coded in the lexicon in an MT system. If so, that is a sufficient justification of the procedure. Whether the semanticist would agree that "real world" information is rightly regarded as part of the meaning of lexical items on theoretical grounds is, in this context, of no consequence.

To summarize. If by FAHQT we mean a "fail-safe" system which accepts for translation texts varying widely in content and style, then there is no reason for us to be any more optimistic about the feasibility, or indeed possibility, of this than such critics as Bar-Hillel were some years ago. I would not exclude the possibility of

constructing a practical system for translating scientific texts from one language to another to some lower, but perhaps tolerable, degree of accuracy. Whether the construction of such a system is feasible or not, I cannot say. But if it is feasible, my feeling is that it will neither contribute very directly to, nor depend very directly upon, advances in linguistic theory.