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Practical Objectives Of Machine Translation Research Closing Luncheon Address

Léon Dostert

I think it is fitting that the sessions of our Eighth Annual Round Table Meeting on Linguistics and Language Studies—focused as they have been on the theoretical, linguistic, and technical aspects of machine translation— should now come to a close on a practical note. This topic, "Practical Objectives in Machine Translation Research", was to have been discussed by a staff member of the National Science Foundation, the institution to which we owe the financial support making our work possible. I am sorry to have to tell you that Dr. Alberto Thompson, Head of the Foundation's Office of Scientific Information, the speaker originally scheduled for this closing luncheon, has been hospitalized since last week. I wish him, in the name of the University and of all of us, prompt and complete recovery. I will do my best to deal with the subject on which he had planned to speak today.

It may well be that, after the scientific approach which has marked the presentation and discussion of the topics listed on our three panels, an attempt to come to more mundane and practical considerations will be looked upon by some of our participants and perhaps by certain of our future readers as being out of tune with the purpose of a gathering such as this. Still, clearly, we must be prepared to recognize that the financial support, without which the research of the increasingly numerous groups now seeking to formulate solutions to the problems of language translation by machine, will not be forthcoming unless our activities are in fact related to practical objectives.

One may indeed wonder whether there is such a thing as pure research. For after all, research is exploration—it seeks to push back ever farther the frontiers of the unknown. It is dedicated to the discovery and formulation of truths for the purpose of serving the ends of man. When the great explorers set out on their journeys into uncharted lands or seas, they may not have been motivated by the desire to claim for their sponsoring governments the new lands to be found. The late Admiral Byrd was, if you will, a pure explorer, but who will gainsay the practical purpose of his voyages in the icy polar seas? We have to live on our world and in our time. A century ago when Pasteur was working in his garret laboratory, with pitifully limited means, he was driven by the will to know, yes; but also, by the desire to protect his fellow man from disease. A century later, the disciplined research

which went into the discovery of antibiotics or Salk's vaccine had a practical end in view. And it is right that this should be true also among the day-to-day workers that we are in the field of machine translation, obscure though we remain. Unless we can and do relate the results of our work to some meaningful and useful end, we shall fall short of one of the true and valid objectives of research, which is to have a purpose—the purpose of serving the ends of man, of improving his lot as an individual or as a member of a cultural group, or of men as members of the related communities that make up the world we live in.

One may, then, quite properly ask, "What are the practical objectives of research in the field of translation of languages by machines?" There may be some who would answer that they are primarily, if not exclusively, interested in what may be called the linguistic results of the investigations—that is, in the inter-lexical, inter-morphological, and inter-syntactic relationships among the languages under scrutiny.

Worthy as that objective is as part of the total purpose of our research, to identify it with the final results that are sought would be confusing the means with the end. Unquestionably, the study of the meaning transfer process between languages, between systems of signalization of experience, looked at from the point of view of its mechanical formulations, will yield significant data for the science of linguistics. I would look upon this as an important corollary gain, rather than as a major objective. There may be others who, and quite properly, because of their concern with adding to the versatility of electronic computers, will look upon research in the field of machine translation as a way of discovering just how much the machine can do. Again, this would be confusing instrumentality with objectives. Doubtless the challenge to the art of electronics posed by the problem of machine translation will lead to significant development in the operations, techniques and construction of computers. But again this ought not to be considered as an essential objective of our research. Indeed, there is the danger that concern with early tangible results in machine translation may lead us to lowering our sights to the process of essentially lexical search which, though not without value, remains far from actual language translation.

Our work has very definite and significant practical objectives. First, the aim of machine translation is to permit ready, undelayed access to scientific information written in the languages of the several scientifically creative cultures of our day. This means that scientists

engaged in diverse fields of research and development will, when we are successful in resolving the problems of machine translation, have more readily available to them the results of the research of their co-workers in other countries with different languages. The lapse of months, indeed of years, which now exists between the date of publication of the findings of, let us say, a Swedish physicist in his own language and the time of their accessibility to, for example, German, French, Russian, Japanese, or American scholars will have been, practically speaking, eliminated. The span of time between discovery and formulation by some, and awareness and sharing by others will have been significantly reduced. The immediate practical aim of machine translation thus is to accelerate communication among scientific workers, regardless of the language in which their findings may be expressed.

But this is only one of the practical objectives of our work. Were our research to serve this one purpose alone, it would be amply justified. The purpose of our work goes beyond this attainment, which is now well within our reach. Let us pause for a moment to consider the economic implications of machine translation. Clearly, if the capital investment required to achieve translation of languages by machine is to be greater than the traditional way of doing the job by employing translators, then no case can ultimately be made for machine translation. No matter what the economic structure of a given culture may be, machine translation will have to justify itself economically. Our Soviet colleagues, who since 1954, after the first demonstration of the feasibility of machine translation in which we participated in association with the International Business Machines Corporation, have been diligently pursuing research in the field, will have, even as we will, ultimately to face the test of cost accounting.

I am well aware that to intrude with these rather earthly preoccupations may displease some of the scientifically-minded among us, but still this very practical problem has to be faced. The time would seem to be at hand to undertake a study of the economics of language translation as now performed through the exclusive use of human talents as against the likely cost of translation by machine. I mentioned earlier that one of the anticipated results of our work will be to reduce significantly the time lag between publication of scientific data and their general availability in other languages, but if this is to entail excessive expenditures, then obviously the tendency will be to put up with the delay. It is my considered opinion that even as the use of computation instruments has proved economically sound in other fields of

data processing, this will be shown to be true in respect to the language translation processes. There is no evidence except by analogy to substantiate this statement, and I hope that the study of relative cost which I propose here will not be postponed.

Parenthetically, this leads to the consideration of another aspect of the general problem. When in January, 1954 the Georgetown-IBM experiment received what some critics have considered undue attention, some of my former associates in the Language Division of the United Nations asked whether this new venture would put them among the unemployed by automation. Obviously, in this field, as in many others, the use of the machine will only serve to liberate human talents for their proper end. I remember how countless man hours were harnessed to the production in four languages of the written proceedings of the Nuremburg Trials. When I recall the long hours of drudgery that gifted translators had to spend in the purely mechanical phase of translation, I am gratified at the prospect that creative human talents will be released for their true purpose in this field by the use of machines. It cannot be envisaged that what we have in our jargon come to call the "output" of the machine will be such as to stand completely on its own. This is where the capabilities of translators will find full expression as revisers or editors of the texts produced mechanically. Even as the development of simultaneous oral interpretation increased opportunities for competent interpreters, so will the greater volume of translation effected by machine provide openings for creative work for capable translators.

So far, then, we have seen that two of the important practical aims of our research are to facilitate scientific communication and to reduce the cost of translation and to free translators for more creative work. There is, I believe, a third area of practical significance in machine translation which is seldom discussed and which has not been widely recognized. The major concern so far has been to move toward the translation of scientific materials from other languages into English. It seems to me that the reverse process can be of equal, if not greater, significance. We know that one of the major obstacles to the dissemination of knowledge, techniques, and skills in the less developed areas of the world is the inaccessibility of technical literature.

I will mention two specific cases with which I am directly familiar. The government's Aid Program in Yugoslavia and Turkey found itself

seriously handicapped by the fact that many technicians who were to be trained in their several fields to higher degrees of competence in modern techniques could not receive their training because of the obstacle of language. It was obviously out of the question to think at that time of the practicality of making the technical literatures in such fields as textiles, animal husbandry, or soil drainage available to them in their native idioms through translations. So a program was initiated to train those technicians in the English language, at very considerable cost and time investment, so that they could receive their advanced training and have access to the current materials in their specializations published in English.

Suppose that it should become practical through machine translation to make available economically the basic reference materials and the current literature produced in the major scientifically creative areas of the world in the local languages of the less developed regions. One of the major objectives of our Foreign Aid Program is to disseminate knowledge in technical fields to ensure improvement of the economy and the strengthening and progress of the social structure. Obviously, if the basic technical literature can be translated in volume and economically, and placed on the library shelves of the schools, technical institutions, colleges and universities of these areas, the sharing of knowledge and spreading of information will be greatly facilitated and broadened. Now that we are witnessing the emergence of national states so rapidly in the hitherto called "backward" areas of the world, it is of the utmost importance to provide accessibility to the kind of information and know-how which will protect these developing peoples from the snares and blandishments of totalitarian ideologies.

We are thus allowed the hope—indeed, the expectation—that the results of our work will have many practical as well as scientific results. Research in machine translation will make a significant contribution to the science of linguistics; it will encourage inter-discipline exchange between the fields of mathematics and symbolic logic on the one hand and linguistics on the other; it will contribute to the increase of the capabilities of electronic data-searching processes. It has recently become quite evident, as a result of our contacts with the patent office researchers in the field of information retrieval and with the reports and statistical service of the Veterans Administration, that there will undoubtedly develop an increasing connection between machine translation on the one hand and the general data-searching and information retrieval techniques on the other. These are less tangible, but very significant objectives. More practically, our work

may contribute to the more rapid and wider dissemination of scientific information; it is likely to increase the scope of data accessibility to researchers in many fields; it may well make volume translation economically feasible; it can be of help to disseminate basic information in many technical fields in those areas of the world where it is urgently needed. These, then, are the practical objectives of machine translation research.

And now let me conclude by expressing our thanks for the support which our several groups have received from the National Science Foundation and agencies of the Department of Defense. On behalf of the University, let me thank you for the valuable contributions you have made to this meeting through the formal papers presented and the discussions which followed them. May I be allowed to give special recognition to the participation in our meeting of a representative of the Cambridge Language Research Unit in England and of his contribution. Perhaps next year it will be possible for research groups from other countries also to join with us in the sharing and discussions of the results of our common endeavors.

It is particularly gratifying that this reunion, following the pioneering work initiated at the Massachusetts Institute of Technology meeting of June 1952, and so fruitfully continued in the conference of October 1956 at the same institution, has brought together representatives of the several disciplines which must pool their efforts in the formulation of solutions to the problem of machine translation. The presence on the panels, in a joint effort, of linguists, computer engineers, data-searching specialists, programmers, and mathematicians is an indication of the increasing recognition that the solution of the problem of machine translation is by no means exclusively a question of linguistic research.

Thanks to your contributions, the next monograph will be a rather up-to-date statement of the status of work in the field of machine translation—at least as adequate a statement as is now available. The distribution which will be given to the proceedings of this meeting will, it is your hope and mine, stimulate increasing interest in the promising field of machine translation research.

I am looking forward to the spring of 1958, when I trust all of us and others can meet to review and discuss the results of our work between now and then.

On behalf of Georgetown University, let me thank you most sincerely.