Meetings

Mechanical Translation: U.S.–Japan Joint Conference

The possible use of electronic computers to translate natural languages was explored at a conference arranged by Panel II of the U.S.–Japan Cooperative Science Program (Tokyo, 20–28 April 1964). Of special concern was the intertranslation of English and Japanese, with particular regard to the exchange of scientific information. The conference was attended by 13 Japanese and 8 American delegates, with many observers present; Yasujiro Niwa (Japan Information Center for Science and Technology) presided. A prime purpose was to familiarize researchers in each country with the status and direction of the research effort in the other; visits were made to Japanese institutions active in the field of automatic translation.

The status and problems of automatic translation in Japan and the United States were first surveyed by Hiroshi Wada (Electrotechnical Laboratory, Tokyo) and F. L. Alt (National Bureau of Standards). The papers which followed were mainly devoted either to linguistic or philological aspects of the problem or to computers and programming.

S. Ohnishi reported on information-theoretic investigations of the Japanese language and on statistics on word frequency, multiple meaning, and frequency of certain word groups or constructions in English. I. Imai presented a rigorous formalization of a simplified grammar of Japanese. B. Koro discussed a classification of verb-preposition government in English, which facilitates the choice of Japanese equivalents in the process of translating into Japanese. O. Watanabe dealt with Japanese verb patterns in connection with translation from Japanese. M. Nagao presented a set of criteria for English-sentence generation expressed in terms of "expansion rules."

Following these highly theoretical papers, S. Iyanaga presented a practical set of rules for pre-editing Japanese text in preparation for automatic translation into English. These rules provide for transliteration into special characters (perhaps the Roman alphabet), breaking down complex sentences into simpler ones, supplying missing (implied) parts of speech, and coping with usages of parts of speech and with the "nuances" peculiar to Japanese. N. Nozaki reported on experiments in machine translation of pre-edited Japanese into English, while T. Sakai dealt with models and strategies in English–Japanese mechanical translation.

H. Nisimura (Electrotechnical Laboratory) described experiments with automatic segmentation of Japanese text as a prerequisite to machine translation. It is customary to print a whole sentence in Japanese as a continuous string of characters with no spaces between them; word separation is being attempted by comparison with dictionary entries, using left-to-right scanning by the principle of longest match. T. Tamati surveyed Japanese computers intended for automatic translation, and T. Kurihara described a machine to be built for the purpose.

Contributions of linguistic theory to problems of automatic translation were surveyed by H. H. Josselson (Wayne State University), dealing with conventional theories, W. S.-Y. Wang (Ohio State University), with transformational theory, and S. Lamb (University of California, Berkeley), with stratificational theory. E. N. Adams (I.B.M., Yorktown Heights, N.Y.) discussed machines for input of text, especially readers of print, while A. Satterthwait (Washington State University) surveyed special-purpose programming languages for linguistic problems. E. D. Pendergraft (University of Texas) spoke on relations between linguistic research and the design of programs for it. Finally, D. G. Hays (Rand Corporation) summarized the American contributions to the Seminar.

Photocopies of the Japanese papers are available from the Office of Technical Services, U.S. Department of Commerce, Washington, D.C. (*Preprints for Seminar on Mechanical Translation, April 1964*; OTS PB 166204. Xerox, $5; microfilm, $1). Copies of the American papers may be had from the respective authors.

I quote significant portions of the official final report on the conference:

"There was general agreement that no single theory would be acceptable to all scholars at present, but that several deserve continued study and offer hope of providing a sound basis for mechanical translation. In Japan, the use of computers has not yet attracted the attention of many linguists; in the United States, few linguists have professional experience with Japanese, whose structure differs in many respects from those of Indo-European languages.

"Since many delegates believed that mechanical translation requires linguistic studies of the languages involved, it seemed desirable for progress in translation between Japanese and other languages to gain the interest of more Japanese scholars, to make their knowledge available in the United States, and to acquaint them more thoroughly with American theory and techniques of linguistic computation.

"Since semantics is important for translation, since it is receiving increasing attention, and since the knowledge of the native speaker is urgently needed in this area, it seems to be a good . . . [area] for collaboration. Although the condition of syntactic studies is more advanced, collaborative study in this area would also be valuable. Obviously, English-Japanese and Japanese-English translation are especially appropriate topics for collaborative research.

"American scientists have almost always used general-purpose computers for language studies, whereas two Japanese groups have constructed special machines. . . . difficulty of access to computers hampers some scholars in Japan, although this difficulty will probably be eliminated soon.

"In the United States, much work has been done on programming languages and systems for linguistics. One

avenue for collaboration is the use of American systems by Japanese linguists. Such a plan would avoid serious duplication of effort.

"In both countries, work on automatic print readers is underway. Successful completion of such a machine will reduce the cost of both linguistic research and machine translation. Meanwhile, it is noted that text can be obtained for study by collection of tapes produced as byproducts of book and newspaper publication. Such tapes could be exchanged with mutual benefit.

"Information is exchanged inadequately between the two countries. Dissemination of titles and abstracts is needed, as are translation and also distribution of semipublished reports to more interested persons. It was suggested that the Association for Machine Translation and Computational Linguistics, the Research Committee for Machine Translation of Japan, and the Information Processing Society of Japan might help with these problems.

"Results of machine translation studies, such as programs or algorithms, dictionaries, and grammars, are not easy to publish, but private arrangements are possible. . . . the value of much cooperative work will be proportional to closeness of collaboration, especially in Japanese-English translation, and vice versa.

"The delegates recommend:

"1) A systematic program of exchange of researchers between American and Japanese mechanical translation projects, especially in the field of linguistics and computer programming applicable to mechanical translation; these exchanges should be used to aid establishment of programs of research on Japanese in the U.S.

"2) Increased availability [of] and ready access to highspeed digital computing facilities for language processing research in Japan and also in the U.S.

"3) Encouragement of continued exchange of published and unpublished reports on an informal and individual basis and the establishment of an appropriate mechanism for the timely exchange of both research reports and published literature, with adequate provision for translation of the significant literature.

"4) That all Japanese reports and articles on mechanical translation and computational linguistics be provided with English abstracts which would be made available to appropriate announcement and dissemination services such as *Computing Reviews* and the Association for Machine Translation and Computational Linguistics.

"5) Exchange of Japanese and English textual material in machine-usable form such as punched paper tape, punched cards, and magnetic tape.

"6) Exchange of coding systems, algorithms and programs.

"7) A second seminar on mechanical translation, after sufficient time and opportunity have been allowed to implement the kinds and means of cooperation suggested in the preceding recommendations.

"8) A planning meeting in the US in 1965 to determine areas for further cooperation; it should be preceded or followed by visits to US research centers.

"This seminar feels it desirable to establish close relationships between the Mechanical Translation Committee of the Information Processing Society of Japan and the Association for Machine Translation and Computational Linguistics, in order to promote the recommended actions, such as 3,4,5,6, on a non-governmental basis."

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Radiation Preservation of Foods

A comprehensive review of research activities on radiation preservation of foods throughout the world was given at an international conference held 27–30 September in Boston, Massachusetts.

S. A. Goldblith (Massachusetts Institute of Technology) opened the conference by challenging the 350 scientists attending to make sound judgments about the safety of foods preserved by radiation. "Let us not allow our thinking to be muddled by 'theoretical hazards' that do not and cannot exist in the practical situation," Goldblith admonished. He pointed to the application of the 12-decimal-reduction-time (12D) principle for thermal processing to radiation sterilization of foods as an example of such "muddled thinking."

Expanding this point, Hamed El-Bisi (U.S. Army Natick Laboratories) described the formulation of the 12D concept as a mere experimental coincidence, supported only by circumstantial, and not by direct, scientific evidence. El-Bisi noted that there was no available evidence to support the claim of industry-wide compliance with the 12D principle in the thermal canning of foods. He called for a positive effort directed toward the establishment of a sound, realistic, and experimentally supported definition of the minimum radiation dose required.

In summarizing studies on the wholesomeness of radiation-preserved foods, Nicholas Raica, Jr., (U.S. Army Medical Research and Nutrition Laboratory) said that recently completed studies indicate that foods electron-irradiated with 11–12 Mev to 5.5 Mrads are wholesome. (Current Food and Drug Administration clearance for radiation-preserved canned raw bacon limits the use of electrons to a 5-Mev maximum.) Raica stated that induced radioactivity cannot be detected in foods irradiated with energies of less than 10 Mev. He explained that, on the basis of theoretical considerations, it has been determined that if a person's entire diet consisted of food electron-irradiated with 24 Mev to 5 Mrad, his total exposure would be 0.26 Mrad per year. It has been estimated that one is exposed to about 150 mrem per year from natural sources and that 5 mrem of this is contributed by fallout.

The pasteurization of fish products by radiation was a major topic discussed at the conference. Kevin G. Shea (U.S. Atomic Energy Commission) said that radiation pasteurization has been shown to extend refrigerated shelf-life of marine products for 30 days or more.

Areas of study pursued by the AEC and the Bureau of Commercial Fisheries in the field of radiation microbiology of marine products include: (i) shifting ecology of the irradiated flora due to variation in irradiation resistance and the unique spoilage patterns resulting; (ii) whether significant numbers of microorganisms which survive are mutants, and what their disease-producing role is, if any; (iii) extent of increase in radioresistance; (iv) synergistic radiolethal effects of food additives (such as nitrates, sodium chloride, antibiotics), concomitant heat, and other agents.

John Dassow (Bureau of Commercial Fisheries) reported that a minimum radiation dose of 0.2 Mrad will give reasonable (two- to fourfold) extension of shelf-life to Pacific crabmeat and flounder fillets at a storage temperature of 0.5°C. He explained that the advantages of using this low