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Milestones in machine translation

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No.4: The first machine translation conference, June 1952

While computers were still in their infancy, just five years after the 'birth' of machine translation (as recounted in Milestones no.1) and only three years after Weaver's memorandum in 1949 had effectively launched research in the field, the first conference took place from 17th to 20th June 1952 at the Massachusetts Institute of Technology. It was convened by Yehoshua Bar-Hillel, who had been appointed to the first full-time post in machine translation (MT) – not as a researcher, but in order to review the prospects and to make recommendations. His survey of MT research (see Milestones no.3) provided the foundation for the discussions.

At this date, very little else had in fact been written about MT. Erwin Reifler at the University of Washington (Seattle) had produced an internal study of the possible roles of human editors before and after translation processes, i.e. pre- and post-editing as he and subsequent writers have called them. Stimulated by Weaver's memorandum, Abraham Kaplan had reported his statistical studies at the Rand Corporation on the amount of context required for disambiguation, concluding that no more than two words either side of a word were needed for resolving any potential ambiguity. Two researchers in Los Angeles, Victor Oswald at UCLA and Stuart Fletcher at the National Bureau of Standards had produced the first publication on MT in an academic journal; this was an investigation of German syntax formulated in terms of a possible computer program. In Britain, there had been a report from Andrew Booth and Richard Richens on their punched-card simulation of word-for-word translations of scientific abstracts.

The MIT conference brought together virtually everyone who had any contact with MT and who might have a future interest. Although unfortunately the full proceedings were not published, some of the papers appeared later in revised forms in the collection edited in 1955 by Locke and Booth (*Machine translation of languages*, MIT Press) and we do have contemporary accounts from Erwin Reifler and Craig Reynolds published in the journal *Mechanical Translation* in 1954 (vol.1 pages 23-32 and 47-55 respectively).

The conference began with a public session, when Bar-Hillel outlined the major issues and problems. From today's perspective it is interesting to note that he laid particular stress on the inevitable imperfection of MT: "completely automatic and autonomous mechanical translation… is, in general, practically excluded, even with respect to scientific texts" and that in practice "machine translation means no more than *mechanical aids to translation*." [Bar-Hillel's own emphasis.] It was his belief that at this time (1952) MT was not economically viable in any of the then conceivable "brain-machine partnerships." However, he insisted that research should continue because:

> "Electronic machines will doubtless become cheaper, human brains probably more expensive. A partnership that could not stand free competition today may well outbid its human competitors in some not too remote future."

This declaration of modest goals set the scene for the conference. There was much emphasis on the necessary role of human pre- and post-editing. Erwin Reifler, for example, suggested mechanical aids for the pre-editor in the form of an automatic dictionary which would display the various meanings of polysemous words and how they might be distinguished for the translation process. Bar-Hillel discussed the treatment of 'idioms', suggesting that the machine should not attempt to translate them but should let the post-editor decide whether a particular "strange-looking" phrase was to be changed to an idiomatic expression or not. For example, he should recognise that in an English translation from German the phrase *it gives* might be a 'literal' translation of *es gibt*, and should therefore be changed to the correct idiomatic form *there is*. Stuart Dodd (University of Washington) proposed a standardisation of English "as a means of simplifying the use of English either as a source language or as a target language." Writers of texts for MT input would employ regularised verb forms (e.g. *She did be loved*), only nominative forms of pronouns (e.g. *I will send he to she*), and standard word orders (e.g. adverbs before verbs, direct objects before indirect). Of course, words would be used in just one (most common) meaning (e.g. *tank* to mean only water tank) or always with a distinguishing qualifier (e.g., always *army tank*). Although extreme, Dodd's proposal was the forerunner of numerous later forms of 'controlled' languages.

It was suggested that the output of MT systems could also be in simplified language. Reifler thought that source-to-target equivalents should be one-to-one as far as possible. The form selected might not be idiomatic but would be understood perhaps as a kind of 'pidgin' language. For example, a Chinese sentence for *He walks quickly* might be rendered word for word as *He walk-ing quick*. (In fact, the use of 'cover words' for effective translation, even if not quite correct, was adopted by many of the early MT systems, and it is still quite common today.)

Another proposed method for dealing with problems of 'multiple meanings' was to identify the usage within a specific subject domain (the 'sublanguage' as it was later to be called). Victor Oswald (UCLA) had investigated the vocabulary of brain surgery, and had discovered that unique translations could be found for 80% of the words used. But it was not only the technical vocabulary that had unique equivalents. Oswald found that even in their use of general vocabulary, most words were used in unique senses, or as he put it:

> "In other words, brain surgeons writing on brain surgery are not only compelled to choose their technical nouns from a limited vocabulary, but their patterns of communication are so limited by practice and convention that even the range of non-technical nouns is predictable."

There were, however, doubts about the usefulness of such statistical analyses. William Bull (also from UCLA) thought that the applicability of the method was very restricted since it was "feasible only if one is dealing with a micro-subject… [and] The number of such fields is, probably, insignificant." Indeed, later experience with sublanguage MT has proved him correct; there are few subjects outside meteorology (the domain of the well-known successful Meteo system) which are amenable to this approach.

The contribution which was the most encouraging for many participants was that of Bar-Hillel on his proposals for an 'operational grammar'. Victor Oswald had reported his already published work on German syntax, which presented usable identifications of 'syntactic blocks' for computer analysis, but Bar-Hillel went a stage further. Based on the work of a Polish logician Ajdukiewicz, he proposed a formalism for grammatical categories and formal rules for combining them in syntactic analyses of sentences. Categories were complexes of

two basic categories *n* and *s*, defined in terms of their potential to combine with other categories, e.g. an intransitive verb was defined as *s/(n)* because it can combine with a noun (*n*) to the left to form a sentence (*s*), and an transitive verb was defined as one combining with a noun to the left and either a noun or phrase (sentence) to the right: *s/(n)[n]* or *s/(n)[s]*. The idea attracted the linguists because it presented a formalism for regularities which were familiar from traditional grammars; and it attracted the computer engineers because it was a formalism which they could easily express in computer programs. (As it happened, Bar-Hillel's categorial grammar was not to be implemented in MT; more popular for subsequent researchers were the formalisms of Zellig Harris and, to a much lesser extent, Noam Chomsky.)

At the end of the conference, Leon Dostert (Georgetown University) suggested that "general MT (mechanical translation from one into many languages)… should be so developed that one translates first from the input language into one 'pivot' language... and from that pivot language into any one of the output languages desired." He envisaged the pivot as a natural language (probably English in the United States), but others thought it could be some kind of artificial interlingua, either a simplified language (as proposed by Dodd) or an international auxiliary language (such as Esperanto). Interestingly, the idea of a 'universal' language was not mentioned – despite Weaver's advocacy in his 1949 memorandum (Milestones no.2). There were, however, a number of speakers who mentioned apparent universal features of languages which might be useful, and Reifler suggested that comparative-historical linguistics would be a good source for such universals.

The conference ended with a discussion of what the next steps should be. Although there was great optimism about the future, it was clear to them all that MT should not be too ambitious too soon – the problems outstanding were too immense to expect rapid progress. Nevertheless, the computer engineers were keen to seek finance for building systems and many agreed with Leon Dostert that there should be the "early creation of a pilot machine… proving to the world not only the possibility but also the practicality of MT." Accordingly, on his return to Georgetown University, Dostert set up a collaborative project with IBM which was to result in the first public demonstration of a working (albeit limited) translation system. This demonstration in January 1954 was to be the next milestone in machine translation.