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## 8.2 Machine Translation: The Disappointing Past and Present

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The field of machine translation has changed remarkably little since its earliest days in the fifties. The issues that divided researchers then remain the principal bones of contention today. The first of these concerns the distinction between that so-called interlingual and the transfer approach to the problem. The second concerns the relative importance of linguistic matters as opposed to common sense and general knowledge. The only major new lines of investigation that have emerged in recent years have involved the use of existing translations as a prime source of information for the production of new ones. One form that this takes is that of example-based machine translation (Furuse & Iida, 1992; Iida & Iida, 1991; Nagao, 1992; Sato, 1992) in which a system of otherwise fairly conventional design is able to refer to a collection of existing translations. A much more radical approach, championed by IBM (Brown, Cocke et al., 1990), is the one in which virtually the entire body of knowledge that the system uses is acquired automatically from statistical properties of a very large body of existing translation.

In recent years, work on machine translation has been most vigorously pursued in Japan and it is also there that the greatest diversity of approaches is to be found. By and large, the Japanese share the general perception that the transfer approach offers the best chance for early success.

Two principal advantages have always been claimed for the interlingual approach. First, the method is taken as a move towards robustness and overall economy in that translation between all pairs of a set of languages in principle requires only translation to and from the interlingua for each member of the set. If there are  $n$  languages,  $n$  components are therefore required to be translated into the interlingua and  $n$  to translate from it, for a total of  $2n$ . To provide the same facilities, the transfer approach, according to which a major part of the translation system for a given pair of languages is specific to that pair, requires a separate device to translate in each direction for every pair of languages for a total of  $n(n-1)$ .

The PIVOT system of NEC (Okumura, Muraki et al., 1991; Muraki, 1989) and ATLAS II of Fujitsu (Uchida, 1989) are commercial systems among a number of research systems based on the two-step method according to which texts are translated from the source language to an artificial interlingual representation and then into the target language. The Rosetta system at Phillips (Landsbergen, 1987), and the DLT system at BSO (Witkam, 1988; Schubert, 1988) in the Netherlands also adopt this approach. In the latter, the interlingua is not a language especially designed for this purpose, but Esperanto.

According to the majority transfer view of machine translation, a certain amount of analysis of the source text is done in the context of the source language alone

and a certain amount of work on the translated text is done in the context of the target language, but the bulk of the work relies on comparative information about the specific pair languages. This is argued for on the basis of the sheer difficulty of designing a single interlingua that can be all things for all languages and on the view that translation is, by its very nature, an exercise in comparative linguistics. The massive Eurotra system (Schutz, Thurmair, et al., 1991; Arnold & des Tombe, 1987; King & Perschke, 1987; Perschke, 1989), in which groups from all the countries of the European Union participated, was a transfer system, as is the current Verbmobil system sponsored by the German Federal Ministry for Research and Technology (BMFT).

A transfer system in which the analysis and generation components are large relative to the transfer component and where transfer is therefore conducted in terms of quite abstract entities takes on much of the flavor of an interlingual system while not making the commitment to linguistic universality that many see as the hallmark of the interlingual approach. Such semantic transfer systems are attracting quite a lot of attention. Fujitsu's ATLAS I (Uchida, 1986) was an example, and Sharp's DUET system is another. The approach taken by SRI (Cambridge) with the Core Language Engine (Alshawi, Carter, et al., 1991) also falls in this category.

Just as these systems constitute something of an intermediate position between interlingua and transfer, they can also be seen to some extent as a compromise between the mainly linguistically based approaches we have been considering up to now and the so-called knowledge-based systems pursued most notably at Carnegie Mellon University (Nirenburg, Raskin, et al., 1986; Carbonell & Tomita, 1987), and at the Center for Research in Language at New Mexico State University (Farwell & Wilks, 1990). The view that informs these efforts, whose most forceful champion was Roger Shank, is that translation relies heavily on information and abilities that are not specifically linguistic. If it is their linguistic knowledge that we often think of as characterizing human translators, it is only because we take their common sense and knowledge of the everyday world for granted in a way we clearly cannot do for machines.

Few informed people still see the original ideal of fully automatic high-quality translation of arbitrary texts as a realistic goal for the foreseeable future. Many systems require texts to be pre-edited to put them in a form suitable for treatment by the system, and post-editing of the machine's output is generally taken for granted. The most successful systems have been those that have relied on their input being in a sublanguage (Kittredge, 1987), either naturally occurring, as in that case of weather reports, or deliberately controlled. The spectacular success of the METEO system (Chevalier, Dansereau, et al., 1978) working on Canadian weather reports encouraged the view that sublanguages might be designed for a number of different applications, but the principles on which such languages should be designed have failed to emerge and progress has been very limited.

## 8.2.1 Future Directions

Research in machine translation has developed traditional patterns which will clearly have to be broken if any real progress is to be made. The traditional view that the problem is principally a linguistic one is clearly not tenable but the alternative that require a translation system to have a substantial part of the general knowledge and common sense that humans have seems also to be unworkable. Compromises must presumably be found where knowledge of

restricted domains can facilitate the translation of texts in those domains. The most obvious gains will come from giving up, at least for the time being, the idea of machine translation as a fully automatic batch process in favor of one in which the task is apportioned between people and machines. The proposal made in Kay (1980), according to which the translation machine would consult with a human speaker of the source language with detailed knowledge of the subject matter, has attracted more attention in recent times. A major objection to this approach, namely that the cost of operating such a system would come close to that of doing the whole job in the traditional way, will probably not hold up in the special, but widespread situation in which a single document has to be translated into a large number of languages.

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