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ARTICLE

The Tower of Babel vs the power of babble

Future political, economic and cultural consequences of synchronous, automated translation systems (SATS)

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Abstract

Since the dawn of human history, language differences have served as a barrier to full intercultural and international communication. The recent advent of synchronous, automatic translation systems (SATS), incorporated into the internet, are but the first sign of a communications revolution as profound as the invention of print. This article briefly surveys the following: (1) text/speech recognition and translation problems; (2) current developments in machine translation (MT) and artificial intelligence (AI) devoted to resolving these problems; and (3) potential future SATS technological developments and uses. The second half of the article is devoted to a wide-ranging analysis of several potentially profound future political, economic and cultural consequences of SATS. The main conclusion points to a paradox: although (perhaps *because*) SATS will lead to greater linguistic (and external-cultural) differentiation, the overall impact will be centripetal – greater integration among the world's peoples, more international peace, and a general higher level of agreement regarding norms and values.

Key words
artificial intelligence (AI) • conflict and peace • internet • future consequences • globalization • language diversity • machine translation (MT) • text/speech generation • text/speech recognition

> And the whole Earth was one language and of one speech. . . . And the people said: come let us build a city and a tower with its top in heaven, and let us make us a name lest we be scattered abroad upon the face of the whole Earth. And the Lord came down to the city and the tower which the children of man built. And the Lord said: . . . come let Us go down, and confound their language *that* **they** may not understand one another's speech. So *the* **Lord** scattered them **abroad** from thence upon the face of **All the** EARTH. . . . Therefore was the **name of** it **called Babel** because the Lord confounded the language. . . (Genesis XI)

Introduction

The mythical message of the Tower of Babel story is clear: should Mankind succeed in developing a single, unified language, we might become 'too' powerful – reaching even the heights of divinity. Multilingualism, therefore, is not only a positive source of cultural diversity but a negative obstacle in the way of increasing humanity's power by preventing greater human unity through inter-cultural understanding.

Human history can be viewed as a series of repeated efforts to regain some semblance of unity through military, political and economic conquest and concomitant linguistic subjugation. Inexorably, however, other languages rose to take over from previous 'lingua franca' and to replenish the overall linguistic pool. Thus, humanity has been forever stuck between linguistic consolidation and segmentation. The centripetal force of military/political unity was balanced out by the centrifugal power of cultural/linguistic fragmentation. Until now.

It is the purpose of this article to describe, forecast and analyze the present and future technologies, and especially the ramifications, of synchronous, automated, translation systems (SATS), which have the potential of 'squaring the linguistic circle': bringing us significantly closer to the unity inherent in the 'Tower of Babel', while at the same time preserving (and perhaps even paradoxically strengthening) the richness and beauty of lingua-cultural diversity – what I call the 'power of babble'.

I shall start with a schematic survey of linguistic difficulties inherent in translation and then offer a brief outline of the technical/technological side of the coming SATS revolution. The latter half of this article will focus on

potential future political, economic and linguistic-cultural consequences of SATS in the future.

DEFINITION

What is 'synchronous, automated translation'?[1] 'Synchronous' refers to the time factor, in this case *instantaneous* or *simultaneous* translation, i.e. the recipient will not feel any perceptible time lag. This, as opposed to *consecutive* or *interrupted* translation, in which the translator enters the picture after a sentence or two, with the speaker pausing and continuing only after the translation is completed.

The 'automated' refers to a system working without human intervention, by means of some sort of artificially intelligent, i.e. advanced, computerized program. As such, it frees us from reliance on other humans and can be integrated into our social environment in practically any form of machine/technology.

Finally, 'translation' indicates a rendition from one language into another which is correct in all respects: in syntax, idiom, phonetics and – regarding text – in spelling as well.[2] Others (Poyatos, 1997) use the more inclusive term 'interpretation' which is actually closer to the mark, given the need to translate not just words but also to interpret paralingual and other integral components of the communications process (see below) – in short, *semiotic* (and not merely semantic) meaning. However, the term 'translation' is kept here, given its more generally understood meaning as compared to 'interpretation' which has multiple meanings (not only in the sphere of translation).

LINGUISTIC AND SEMIOTIC TRANSLATION PROBLEMS

One can discern eight separate levels of artificial (machine) communication (Roe and Wilpon, 1994). First, simple *text recognition* in which the system is able to discern (not 'understand') textual language and provide basic information based on such discernment. This is the underlying technology for internet search engines. Second, *speech recognition*, whereby the system discerns spoken language and can react to that speech in a pre-formatted way. For example, airline reservation systems can pick out such spoken words as 'night flight', 'London', 'first class' and provide the requisite information. Third and fourth, we have text or speech *comprehension*, in which the systems actually 'understand' what they are 'reading'/'hearing'. Fifth and sixth are text or speech *generation* systems, whereby full-fledged communication (textual or spoken) is independently engendered by the machine. Finally (seventh and eighth), we arrive at machine text or speech *translation* (SATS).

Within each category there are separate problem areas, some of which are quite advanced while others are primitive. Moreover, in general, one can say

that all text systems are more advanced than their speech counterparts due to the far greater number of speech variables compared to text variables which the technologies (hardware and software) must take into account. The following is a highly schematic survey of many (not all)[3] of the linguistic difficulties which have yet to be resolved for machine systems – the first seven relating to text and speech, the remainder to speech alone. For most of them, a brief explanation will be appended (in parentheses) regarding possible solutions. A more general technological survey providing background to these solutions will be offered in the section following this one.

1 Infinite word sequences

Any language with a 60,000 word vocabulary (some have much more, e.g. English, others have less) theoretically can have 3.6 billion two-word sequences. The 'perplexity' (i.e. the geometric mean of the number of words that can follow a specific word) escalates exponentially when the SATS must take three-, four- and five-word sequences into account for 'contextual' comprehension. Thus, one of the first goals in programming SATS is to teach the system how to discard 'impossible' or unlikely word sequences (e.g. two verbs, one immediately after the other) – otherwise the system runs out of memory space very quickly. (Vastly increased memory in future computer systems will alleviate part of the problem; 'artificially intelligent' algorithms will enable more effective discarding of unfeasible sequences.)

2 Homographs and homophones

SATS must 'understand' sentence context because every language has a huge number of words with the same spelling (homographs) or the same sound (homophone). A homograph example is 'bank' which can mean 'a financial institution' or 'side of a river' or 'gradient'. An example of a homophone which might give a SATS hives: 'two bee or not two bee'. The degree of homographic complexity can best be understood by the following fact: the 500 most often used words in English have 14,000 meanings – on average, 28 meanings for each word (Samovar et al., 1981: 140). (Programs which understand grammar, syntax and context are in development.)

3 Idiomatic expressions

Many times the meaning of a word or series of words is non-literal: 'he took a *bath* in the stock market' or '*go fly a kite*' are not to be understood as bathing on Wall street or mimicking Ben Franklin. SATS must understand that expressions are occasionally *more* (or different) than the sum of the

sentence's (word) parts. (Idiomatic expressions are finite and their meaning/s can be programmed in much the same way as single words.)

4 Non-equivalency

Relatively few words have a one-to-one equivalency in two different languages. Many words, in fact, have numerous, possible, literal translations, each dependent on the nuance and context of the sentence's meaning and specific language. Knowing which specific word to use requires not merely a mastery of the target language but a great deal of 'understanding' of how the real world works. One example, here is some of the English definitions of the German 'Zug': air hole, block, cords, draft, draw, flue, groove, length of chain, pass, ply, pull, register, stop, stroke, tack, traction, train, etc. Moreover, non-equivalency also exists *within* one language: in England, one clips 'braces' on one's pants (suspenders) whereas in America 'suspenders' belong there ('braces' go on the child's teeth). (Trans-linguistic non-equivalency is a serious obstacle which will only be overcome when true artificial intelligence is developed in the field of semantics; intra-language non-equivalency merely demands that the system be aware of the specific sub-language – British vs American – of the receiver.)

5 Neologisms

People are constantly making up new words or adapting foreign words to their own language. SATS must first conclude (as do humans) that an 'inadvertent' error did not occur – either in the sender's message (misspelling, mispronunciation) or in its own 'reading/hearing'. After determining that it is dealing with a 'real' word, SATS must then try to decipher it using several non-conventional heuristics. Complicating matters even more are other words not found in the dictionary: proper names, foreign names in transliteration and the like. (See next section for the system-wide solution to this.)

6 Sub-cultural language

Many societies have 'outgroups' which develop a sub-language (i.e. argot) for reasons of self-identity and behavioral camouflage. The vocabulary of such groups (e.g. prisoners, derelicts, homosexuals) is identifiably of the native language but the words' meanings are non-standard. For instance, prostitutes will use the terms 'steak', 'roast', and 'hamburger' in a distinctly non-culinary sense. (Identifying the self-identity of the sender would solve this problem.)

7 Incommensurableness and ineffability

The objective reality of one person may be quite different from that of another who lives in a different physical environment. Here SATS (as all

translators) are faced with a problem of incommensurableness. How does one translate 'rice' to an Eskimo when the word (and the object) does not exist within an Eskimo milieu? Moreover, subjective reality is even more problematic due to its ineffability (lack of concreteness), based on one's cultural perception and value system: '. . . concealed in the structure of each different language are a whole set of unconscious assumptions about the world and life in it' (Kluckhohn, 1976: 142). For example, there is no term for 'late' in Pueblo Indian; no 'trespass' in some Arabic languages. Terms may also have completely different 'meanings' in two divergent cultures; for an American, the word 'dog' conjures up a cute, furry pet; for a resident in Hong Kong the connotation is of a culinary delight. (See later section on Culture, Language and the Limitations of SATS.)

8 The problem of pause

Natural human speech has very few pauses between words. SATS, therefore, today have difficulty even identifying which words the communicator is expressing, let alone successfully translating them. Toacomputertoday, thesentencesoundsmuchasitiswrittenherewithoutspacesbetweenthewords. Compounding the problem, of course, is the fact that different people talk at different speeds, with different pause patterns. (Systems today have begun to overcome this problem by 'learning' the voice cadence of specific speakers.)

9 Spontaneous speech, hesitation and irrelevant sounds

Eh, umm, ah, hm (etc.) are all part of our natural speech, providing us with additional time to gather our thoughts before our next verbal barrage. Especially at the start of a sentence, hesitation can also mislead – does it connote a new subject or 'strong' punctuation (Butterworth, 1975)? False starts also issue forth confusing sounds. To a SATS, though, these sounds must be taken as seriously as regular words because a sound is a sound – further complicating 'understanding'. (Such voice sounds can be included as part of the SATS 'vocabulary'.)

10 Accents and dialects

Most languages have regional speech accents (the way the words are pronounced) and dialects (differences in vocabulary). To be proficient merely in English, SATS would have to know several British (including Welsh and Scottish) accents, in addition to several more in 'American', plus a few in South African, Australian, Irish, New Zealand, West Indies, Indian and Pakistani, as well as others around the globe. Add to this 'Pidgin English' dialects, and it's already a mouthful. (The solution here is similar to number

8 above; also, SATS can prompt speakers to identify their geographical dialect.)

11 Intonation

Some languages give the intonation of words an important place in speech communication; indeed, some Japanese words have up to eight meanings for a single word, depending on intonation, i.e. pitch and volume (Hart et al., 1990). Even worse, the use of nuanced intonation at times is meant to signify a meaning the exact opposite from the literal translation, as in irony and sarcasm. These further complicate the work of a SATS, requiring such a system to have a 'hearing' sensitivity at least the equal of humans – not to mention (in the case of irony, etc.), a contextual understanding beyond the words themselves. (This is arguably the most difficult problem for SATS and will demand the highest level of contextual understanding.)

12 Environmental noise

Not only must the translation program deal with speaker linguistic and phonetic diversity, but also with environmental 'noise' which can distort the sound of the spoken language (Juang, 1991). Noise cancellation technology is highly advanced regarding stereo music systems, but the difficulties involved in identifying and negating spoken noise are far greater. Moreover, background noise is also important in explaining other aspects of 'meaning'. For example, SATS must be able to recognize that a speaker is raising her voice not out of anger but rather to be heard above the noise in the room. (Here too, perfection will be hard to attain regarding the last point; the other problems are 'technical'.)

13 Social context and physical accoutrements

The social environment as well as objects which accompany the speaker are also critical to understanding (and translating) speech. Translators must take into account the following parameters when assessing the 'sub-text' of speech: rank (status), manner (in/formal), atmosphere, relationships (friend/stranger), ego, underlying purpose, gender (Weale, 1997: 309). For example, calling someone a 'son of a bitch' has an altogether different meaning if the conversants are close friends than if they are strangers; using the term 'du' instead of 'sie' must be translated-interpreted differently if the speaker is of much lower status than the listener (here it's a term of contempt) than if they were friends.

Complicating matters even further are physical accoutrements such 'body-adapters' (clothes, jewelry, food, drink, cigarettes, etc.) which provide cultural meaning and can affect the translation. In short, SATS will have to be 'world-wise' in general and event-sensitive in particular. (Visual 'artificial

intelligence' is quite underdeveloped; this problem will be resolved only at a much later date.)

14 Non-verbal communication (NVC)

Approximately two-thirds of social-emotional messages (and a significant amount of substantive information) are transferred through what is commonly called 'body language'. NVC obviously plays an even more critical role in inter-cultural communication (the milieu of translation), providing additional clues for 'correct meaning' when faced with ambiguity as a result of the difficulties noted above.[4] Indeed, at times NVC can contradict the verbal message (e.g. aggressive words and tone accompanied by frightened face and contracted body posture which usually convey the true message). On the other hand, NVC also needs 'translation', as body signs (e.g. hand movements) can signify different and even contradictory things for two different cultures.

Thus, in order for SATS to perform its job maximally it will have to include a visual component, in addition to what Poyatos calls 'oral footnotes' (1997: 262): the ability to 'see' the speaker and perhaps also – in the case of electronic/virtual communication – to provide corresponding pictures (i.e. 'translated' body language) in NVC semiotics of the receiving culture. Indeed, it is not too far-fetched to envision a time in the more distant future when SATS will project two-dimensional screen (or even three-dimensional holographic) 'avatars' using 'translated' NVC signs, movements, etc. of immediate cultural recognizability to the receiver – a sort of interpretative pantomime accompanying the verbal translation. (The solutions noted here are purely theoretical at this stage, but given the relatively finite number of key NVC signals, ultimately SATS will be equipped with a reasonable ability to 'translate' non-verbal language as well.)

PRESENT AND FUTURE TECHNOLOGIES

Current state of the art[5]

Some significant advances have been made in automated *speech recognition*, with word error rates dropping by a factor of 2 every couple of years (Cole et al., 1996, sect. 1.2.2). Speech recognition technology has already begun to appear in commercial products (e.g. top-of-the-line cars; personal communicators). A few examples among many: Siemens' DICE is a 'text-to-speech' program which can turn textual email and internet pages into voice-mail in many languages. Dragon Systems' voice recognition program ('Naturally Speaking') enables a personal computer to understand ordinary speech (enunciated relatively slowly and clearly). Kurzweil's 'Voice Xpress Plus' does much the same, providing one's PC with the capability of receiving oral 'command and control' instructions as well as oral dictation. California-based One Voice Technologies Inc. has recently launched a

program enabling people to talk to their computers using everyday speech in all of the major European languages, in order to access files, surf the web, check email, etc. (*Time Magazine*, 1999).[6]

Of course, this is but the second and more difficult stage, coming after *artificial (synthetic) speech*'s successful introduction and widespread implementation – from simple telephone number information provision to direct marketing, complaint handling, and customer service communication. As we shall see, these will form the basis of the next, more advanced stage of SATS – oral/voice translation – beyond textual translation which already can be found in widespread use, especially on the internet. Probably the most widespread program in use today is 'Babylon' – an automated translation program on the internet, working in several languages. It has competition: AltaVista's 'Babelfish' (based on SYSTRA technology) automatically translates whole internet pages between 13 pairs of English, French, German, Italian, Spanish, and Portuguese.[7] Globalink's Comprende (www.lhs.com) enables surfers to participate in a live multinational chat with translations to and from English.[8] Finally, as a harbinger of the next stage in the global village revolution, the Honk Kong-based website *www.isilk.com* now provides instant text translation from Chinese to English and vice versa (*Time Magazine*, 1999).

These systems, while impressive, still do not approach near-perfect translation (Babelfish scores about 65 percent), especially due to the problem of syntactical differences between languages (Dorr, 1994). Nevertheless, we can expect text-based translation in cyberspace to be highly comprehensible within a decade. However, it is important to realize that the present state of mainly textual cyber-communication is a passing phase – once more developed, voice-to-text, text-to-voice, and voice-to-voice communication will become the future standard.

Despite numerous difficulties, speech *translation* has made significant strides of late. The global C-STAR II (acronym for Consortium – Speech Translation Advanced Research; see www.is.cs.cmu.edu/cstar/), funded by Siemens, Carnegie Mellon University and Japan's ATR, among others, has already perfected a topic-specific translation program which enables teleconferencing among Japanese, South Korean, Italian, French and US scientists: 'Everyone speaks his native tongue, and the computer system . . . translates into any one of six languages' (Baker, 1999: 22). Other translation systems such as JANUS (Interactive Systems Labs) utilizing a 3000–5000 vocabulary size have already managed to reduce response time to less than double real time (Interactive Systems Labs, 1999a).

The pre-eminent company working in the field (financed in part by Microsoft) is Lernout & Hauspie. This Belgian-based company markets computer-dictation programs and internet translation applications. It is presently developing (along with Intel) 'machines that understand verbal

queries, hunt down information, and provide answers over the phone' (Baker, 1999: 23). As the company's CEO describes the system: 'You ask it about L & H stock, and it knows to call up Nasdaq.com' (Baker, 1999: 23).

Future developments[9]

Given the multiplicity of difficulties, one might be tempted to say that practical SATS are decades away at the least. However, new approaches in artificial intelligence (AI) research (neural network,[10] parallel processing, fuzzy logic) enable 'intelligent programs' to teach themselves through trial and error – exactly as a young toddler does. Indeed, while evolutionary development of the human brain has the advantage of being 'pre-disposed' to learning language naturally, AI has a different advantage: speed of learning – both from the standpoint of the time it takes to cram (download) an entire dictionary into its 'head' (seconds) and the amount of time it can devote to learning a language (24 hours a day without interruption, etc.).

Of course, brute lexical spoon feeding is not enough. AI systems must also possess 'real world knowledge', i.e. must advance to the point where they can pass some semblance of the Turing test.[11] While we are still some distance from that momentous day, translation research has begun to include this knowledge base approach within its broad confines (Goodman, 1989; Nirenberg et al., 1991). One interesting example is the University of Southern California's 'Ontosaurus' which sorts 90,000 concepts into a branching hierarchy according to the way they are used in language: qualities, processes, objects, interpersonal things – each sub-divided in turn through multiple hierarchical layers (Budiansky, 1998).

Moreover, as the last 'S' in its name indicates, SATS is a *system*. Each SATS user will be communicating not with an 'individual', local medium, but rather with something which is highly networked, thereby potentially increasing SATS's learning curve almost infinitely.

For example, let us take the present internet – keeping in mind that in the not-too-distant future all media will be 'wirelessly' linked, so that this example is relevant to all future automated speech and translation. Sun Microsystems Inc. recently announced that it is converting the 'Star' word processing suite into a continually downloadable 'Software on Demand' whereby 'any time they [the users] fired up the software from the Net, they would automatically get the latest version' (Burrows et al., 1999: 47). The same principle would hold in the future for SATS: when downloading a text translation system, it would arrive with the most recent 'improvements', i.e. the latest neologism used by someone else yesterday which her SATS had to translate, and thus is now part and parcel of today's program (assuming that she didn't nix the translation). Moreover, in the completely networked world of the future, if a 'personal' SATS has a problem in translating something it will immediately send out a query to all other SATS

around the globe (precisely as we do today with search engine questions on the internet), to see whether any other SATS has a satisfactory translation. The underlying technology for this is already at hand in principle: 'Gurunet' (www.gurunet.com), which provides instant dictionary definitions and other updated, real-time information for any term in your (word processing or internet) document, as long as one is on-line (Wildstrom, 1999).

Moreover, based on this fundamental 'internet' idea, the overall system could contain instantly downloadable specialized language modules (professional, technical, exotic language, etc.) – probably from regional 'servers' – thereby enabling each individual SATS to function with far less memory than would be necessary if we expected full translation capabilities (5000–6000 languages) of each and every private SATS.

One other technique which promises to significantly reduce several speech recognition problems is *speaker* recognition (Cole et al., 1996: sect. 1.7; Furui, 1991). While used today mainly for security purposes, it will probably be extended to speech comprehension purposes in the future. Each SATS would identify the specific speaker (probably by voice pattern) and thus immediately be 'in tune' with that speaker's individual speech idiosyncracies (intonation, pause, accent, etc. – and perhaps also lexical style, e.g. vocabulary, slang) – thus alleviating several of the difficulties mentioned above.

Overall, then, such system-wide learning, reliance and backup will render SATS virtually (in both meanings of the word) omniscient in its translation capabilities. The solutions to the many linguistic, technical problems noted above will evolve not only through more sophisticated programs (some of them even multi-program systems[12]), but also in parallel with and as a result of the more general improvements (greater bandwidth, faster speeds, better connections) in cyberspace particularly and the overall media environment in general.

It is obviously impossible to predict with any precision when high-level SATS will be operational but the continuing evolution of computer power suggests that it will not be in the distant future. This assessment is based in part on Moore's Law regarding the doubling of computer power every 18 months.[13] Even this might be too conservative a prediction, as IBM announced in late 1999 that it will have an operational teraflop super-computer by 2005 (one *trillion* operations a second) – approaching the capabilities of the human mind in complex information processing, the basis for true artificial intelligence (Kurzweil, 1999).

One further important factor underlying guarded optimism with regard to SATS's future development is financial: expanding investment due to its gigantic economic potential. In the past, after the initial enthusiasm and substantial government funding for 'machine translation' (MT) in the 1950s, such support subsequently dried up, resulting in the virtual stoppage of MT

research until the 1980s (Hutchins, 1986). Thus, its 'lack of success' is due in large part to the lack of broad-based effort until recently. Similar to what is occurring in space, private corporate investment is now taking up the slack, with the growing realization by such corporate powerhouses as Philips, Siemens, IBM, Intel and Microsoft that SATS is a financial gold mine waiting to be developed. At present, the voice-recognition and artificial-speech industry alone already has a $1.3 billion annual volume of sales (Baker, 1999: 22). Among other factors, a tremendous impetus for such R&D is the overwhelming need of 1.5 billion East Asians to bypass the complexity of their non-alphabetic written characters (*Business Week*, 1999: 25).

This potential is a function, in large part, of the fact that cyberspace is moving into the wireless age; SATS will be extremely mobile, enabling users to function anywhere. Moreover, the growing miniaturization of computers – indeed, the demise of 'computers' in their traditional form, replaced by chips-in-an(y)-object – further increases the possible uses, and economic potential, of SATS. And again, the instantaneous interconnectivity of networks will enable local SATS to perform at levels which might be impossible were they to rely entirely on their own 'individual' resources.

How might such SATS be used? In the future, all computers, radio and television sets – indeed, all forms of media – will be 'SATS Inside' (to use the Intel expression). So too will be the entire global phone system – whether cable or satellite – which is already doubling as a major carrier of mass infomedia (internet radio and TV), person-to-person data (e.g. document files) and media-to-person information (e.g. stock market reports).

However, SATS will not stop at the 'mass media' door. Should a person find herself in a foreign land, at a time when virtually every artifact, item and object in our world will be voice-activated, she need merely ask 'open door' in her native tongue and the built-in SATS will understand the message. Ditto for driving a car, turning on the hot water ('21°, medium pressure'), and so on.

No less important, of course, is inter-personal communication. One can imagine the phone system automatically translating in the respective languages of the caller's and recipient's first words. As to face-to-face conversation between people speaking different languages, the ever-present, super-miniaturized cellular phone in their ear(ring) (literally) can double as the SATS – picking up the other conversationalist's spoken voice and translating it directly into our ear(s). If both partners have such a medium, then that is all that is needed for full SATS discourse. Situations where only one talker is SATS-equipped will be discussed below (see 'International Tourism').

Just as widespread are 'passive' messages in the social environment which will continue to be exclusively textual: street signs, billboards, shop window displays, and perhaps even traditional books. For such circumstances the SATS will be built into a person's eyeglasses/contact lenses/helmet-pane.[14] A sign in France stating 'Paris huit kilometres' would appear on the American's eyepiece as '5 miles to Paris'.

In short, 'SATS-within' communications devices, systems and media that might be in widespread use in the future for other informational and communication functions, could turn any and all foreign language 'environments' into a mono-lingual one for each and every user – whatever native language she or he talks.

CULTURE, LANGUAGE AND THE LIMITATIONS OF SATS

Before outlining the consequences of SATS, we need to further clarify the nexus between language and culture (and the place of the translator in between). Such clarification will place the relative force of these consequences in better perspective.

Can one completely distinguish between – or divorce – language and culture? The obvious answer is no. Can one ever attain total and complete translation from one language to another? Most probably not. There are two somewhat related reasons for the latter answer: a) 'technical', and b) 'essential' (the basis of the first question). Technically, the act of translation, as we saw earlier, is fraught with obstacles and difficulties. The following confession of a professional (prize-winning) translator sums up the situation aptly and succinctly:

> The interpreter . . . has to try to 'understand' the original speaker. . . . He then has to reproduce another speech. The skills needed to do this involve a whole range of disciplines such as psychology, cultural anthropology, and philology. . . . This also involves in a split second, deciding the way he interprets the non-verbal presentation of the speaker. It also involves such things as hearing, storing of memory, primary and secondary recognition, long term memory, and discerning 'units' of meaning. (Weale, 1997: 306)

In short, the perfect translator-interpreter would have to be a super(wo)man, bridging not only specific social science disciplines but also different 'mental worlds'.

However, in any event the goal of perfection is unattainable for the precise reason that the deepest meanings underlying any specific tongue cannot be separated from the culture from whence that language springs. Taylor (1971: 24) speaks of 'the artificiality of the distinction between social reality and the language of description of that social reality'. As Derrida (1985: 181) puts it, in embarking on the process of translation, 'one thinks of the way in which Kant at times defines the relation to the sublime: a presentation inadequate to that which is nevertheless presented'.

What does this mean regarding SATS? Two complementary things: it will probably never reach absolutely perfect 'interpretation' – but then again, neither have, do, or will human translators. Thus, the question is whether SATS will be able to translate/interpret the semiotics of one culture into another at the same high level of the best human translators today.

The answer to this question is complex. On the one hand, it is hard to see SATS in the foreseeable future reaching an artificial intelligence which would enable it to be an expert psychologist, cultural anthropologist and philologist all rolled into one. True, 'expert systems' have already been developed in many areas of human endeavor (by 'picking the brains' of experts in the field), which have attained equality, and at times superiority, relative to the human experts in their circumscribed, and well-defined, professional fields. But here we are dealing with inter-disciplinary complexity of a higher order and far wider scope, for language involves the full panoply of human endeavor.

Yet there are other considerations which give SATS an advantage over humans. First, multilinguality. The best professionals today are capable of excellent translation in three to five languages; because of their virtually unlimited memory and networking, SATS will be able to translate an almost unlimited number of languages at any one time. This is a significant quantitative advantage to offset its qualitative disadvantage. Many of the consequences to be described below will have much wider global scope precisely for this reason, reaching those tongues and cultures either too small or peripheral to have any significant number of expert human translators today.

Second, SATS should be able to add a visual element to its 'interpretation' which human translators today cannot provide (other than some rudimentary body language). In other (than) words, the problem of trans-cultural translation in the future will be partly (and at times, greatly) ameliorated by the fact that in a multimedia environment most text and speech can be accompanied by visual material which the SATS will have at its disposal for instant display. Thus, linguistic translation of particularly difficult terms, strange objects, unusual concepts, etc. will be augmented by different sorts of futuristic visual media more amenable to cross-cultural comprehension. The Eskimo reading about Japan will *see* the grain of rice; the audience viewing a speech by a prostitutes' rights advocate will get a picture of what her 'steak' looks like.

There remains a final problem which SATS will have to deal with, one suggested earlier: if two cultures place a different value on the same concept, should SATS translate and present it from the perspective of the sender, the receiver, or both? 'Freedom' is a term understood in both China and America, but it obviously 'means' different things to each culture. To the extent that the major goal is inter-cultural, *semiotic* comprehension, the

obvious choice is 'both' – despite the price in heightened translation complexity; if the goal is mere *semantic* understanding, then we shall probably program SATS to translate in terms familiar to the recipient. One can envision a situation where each recipient (or sender) decides the question and SATS provides the requested result.

In short, the problem of precise, connotative, culturally contingent translation will not disappear or be fully resolved by SATS. However, this didn't stop the Moderns from writing dictionaries and thesauruses. Similarly, the improvement and growing use of SATS – even if never close to perfect – will still constitute a marked improvement over the mass inter-linguistic silence or incomprehension which exists today between most languages and certainly between the vast majority of the world's populace.

FUTURE CONSEQUENCES

Any attempt at future prediction must beware (and be aware) of several pitfalls. The first is an overly simplistic extrapolation of technological development. Who would have believed in 1960 that the video-phone would be a resounding failure? Who could have predicted in 1990 the incredible success of the internet within one decade? Second, the computer and (subsequent) internet revolutions have shown us that many uses to which 'compunication' technologies are put emanate from 'below', i.e. from the public, and not from 'above', i.e. the inventors/marketers. Thus, the following list is far from exhaustive – and at least some of the specific predictions not altogether correct – given the impossibility of predicting how six billion (plus) users will further improve and unexpectedly utilize such SATS technologies.

I shall restrict my analysis in this exploratory article of SATS consequences to three broad categories: political, economic and cultural. Obviously, there exists significant overlap between them – no attempt will be made to 'compartmentalize' the predictions too strictly.

Political

1

Language is a major political irritant in many countries, and in several it constitutes the central point of cleavage. Some examples: Belgium, Canada, South Africa (English vs Afrikaans vs Bantu). A full-fledged SATS environment, however, offers the promise of reducing some of this friction, thereby *alleviating* – at least to some extent – *the problem of 'language war'*. SATS enables both sides to continue using their own language, even in discourse with the other linguistic group, without endangering national cohesion (inter-group communication remains at its normal level) and

without the minority having to worry about the gradual disappearance of its tongue.

2

A related consequence, albeit on a 'higher' political plane, is *the reduction of antagonism to regional integration*. With the European Union and the NAFTA accord leading the way, the 21st century looks to be an era of super-national integration. However, one of the major stumbling blocks in this process is the fear that continental/regional political consolidation will lead to local/national linguistic-cultural obliteration. Once again, universal SATS should alleviate that (presently well-grounded) fear, for all communication and travel within the regional political entity can take place in a linguistically friendly environment for each language group in the emerging super-polity.

3

These two consequences are related to (and influence) a third area – in public policy making: *the decline of language planning*.[15] Two tentative conclusions can already be offered: first, there will probably be less need for government involvement in language planning; second, even if the authorities wanted to continue along that path, SATS will undercut the whole language-planning process.

First, the immediate political need for sound language planning is lessened by SATS (for instance, regarding the teaching of languages; see below 'Economics', number 2); the authorities will invest their energy and resources elsewhere. There is one possible factor, regarding increased migration and recrudescent xenophobia (discussed below, number 6), which could still leave a need for government language planning.

Second, once everything is open to automatic, instantaneous translation, it is not easy to foresee which way any particular society will develop and what its language needs will be (if any). No government would wish to commit large-scale resources to language planning in an environment fraught with so much uncertainty and revolutionary change.

4

International crises today develop at record speed, in large part due to instantaneous mass communication which puts enormous pressure on the leadership to respond 'immediately'. With hot-line SATS, *world leaders can communicate with each other directly*, without the logistical, real-time and security encumbrances of translators. Many unexpected political 'irritants' can thus be quickly smoothed over before blowing up into full-fledged international crises.

To be sure, the problem is not just speed but rather accuracy as well. It is almost unheard of today for a translator to stop a government leader in mid-sentence to ask for the precise meaning of what was said; SATS will have no psychological compunctions about doing so – or disinclination to warn the receiver about translation ambiguity so that she or he could ask the leader for the exact meaning. One need hardly note that in diplomacy, the nuanced meaning of words can have major political significance – and misunderstanding due to mistranslation can be catastrophic. The bombing of Hiroshima and Nagasaki may well have been the most extreme example of this (Farb, 1974: 197).[16]

5

Language still presents a significant barrier to McLuhan's 'Global Village' – on the internet even more so than on television – for it is easier to passively understand a foreign language (TV) than to actively use it (internet chat). SATS will change that, abolishing this barrier and thus *opening up truly linguistically unencumbered discourse between peoples* with ramifications regarding inter-cultural communication and understanding and ultimately world peace. Suffice it to quote Warren Weaver, one of the Rockefeller Foundation's top executives, writing to Norbert Weiner (father of cybernetics) back in 1947: 'A most serious problem, for UNESCO and for the constructive and peaceful future of the planet, is the problem of translation, as it unavoidably affects the communication between peoples' (Hutchins, 1997: 22).[17]

6

If the above are mainly positive, the final political consequence is a mixed bag: *increased international migration*. While other obstacles to migration abound (e.g. paying airfare, danger of illegal border crossing), the most significant factor in an immigrant's calculus is language, for without knowledge of the local tongue the initial few years will certainly be extremely difficult. However, with universal SATS implementation, the problems involved in finding and keeping employment (and in other facets of life) in the foreign country are far smaller, as all local media/discourse can be efficiently translated.

This does not mean that such economic absorption will necessarily be accompanied by social assimilation. In the past and present, those who do not speak the native language are considered to be 'outsiders'; thus, their short-term economic problems are ameliorated but not so their inferior status within general society which reduces their chances of upward economic mobility. As a result, SATS could at one and the same time provide economic relief for millions of (im)migrants and at the same time perpetuate their socio-political powerlessness.

Nevertheless, the future might be different in this regard. If one assumes that current communications globalization will continue apace, i.e. as a matter of course the average person will be communicating daily (through work or internet leisure) with people from other cultures who speak foreign languages (SATS-mediated), then the very notion of 'linguistic superiority' might ultimately be undercut. For *everyone* will be in the same boat of speaking a 'minority language' on the world scene. In short, SATS will not only expand our communication horizons but concomitantly also have our personal linguistic hubris cut down to size. Thus, the foreigner in our midst speaking to us locally through SATS mediation, might in the end look like nothing else than ourselves communicating on the world stage.

That might (or might not) occur in the somewhat distant future. Meanwhile, over (at least) the short-to-medium term, immigrant native-language retention will probably lead to greater local xenophobia, as can be seen already today in the rise of political groupings such as the French National Front, German Neo-Nazis, Austrian Far Right, etc. It is already clear that in the not-too-distant future many of the more advanced economies – most European countries and Japan – will need to 'attract' huge numbers of foreigners in order to supplement a rapidly declining youth population. Thus, instead of eventual linguistic and cultural integration as has occurred among most immigrant groups from time immemorial, the SATS future may hold within it greater domestic, linguistic fragmentation among immigrant nations – leading to heightened political turmoil.

Economic

1

The most obvious economic consequence will be *the virtual disappearance of the translation profession*. First textual translation will disappear, and ultimately oral translators. However, in the short-to-medium term there might actually be an increase of work for translators in developing their 'inheritors': linguistic 'expert systems' which take much time and effort to 'train' (from the content perspective). Lernout & Hauspie, for example, today employs translators from 18 countries, with each language 'pair' taking up to a year-and-a-half to complete (Kushner, 2000). In addition, most translation-related ancillary businesses would be adversely affected, such as dictionary compilers, publishers and the like.

2

A corollary of this would also be *a marked decrease* (perhaps total abandonment) *of foreign language courses and materials* (audiotapes, do-it-yourself books) for the general public[18] – thereby economically decimating

those sectors dealing in the instruction – formal and informal – of foreign languages. Indeed, one can envision a day when a second language won't be a requirement within any level of schooling. Instead, we might see an increase of 'inter-cultural' studies in primary/middle/high schools and in higher education, to make up for the lack of first-hand linguistic knowledge of other peoples. This would be a small price to pay, as one can learn a lot more about another culture through direct cultural studies than *in*directly through sweat and brow rote learning of that culture's foreign language.

It should be pointed out that this would merely continue and expand western educational trends in evidence over the past 50 years (at least). The decline of foreign-language instruction (excepting English as a second language in some European countries) can be explained in part by the huge expansion of easily purchased translated material: books, magazines, newspaper articles, guide books, dubbed video, popular music reissues in foreign languages, etc. However, this 'abundance' of translated works is but a drop in the bucket compared to the SATS flood up ahead. In such a translation-rich environment, the educational system will be under immense pressure to put its resources into teaching the essence of foreign cultures as expressed in concepts, values, norms of behavior, etc. – precisely those things which are so difficult to 'translate' linguistically.

3

On the other hand, the *savings in reduced costs of translation* will be immense. For example, EU institutions today spend close to half of their running costs on translation work (Arnold et al., 1994: ch. 1), and this accounts only for translation work actually carried out and not translations which could/should have been done (but weren't for budgetary reasons). The EU employs about 2000 translators to handle 11 languages. Already today, approximately 10 percent of its translations are done with Systran systems and the figure is growing rapidly, especially for quick and 'dirty' in-house (non-official) translations (Budiansky, 1998). At 10–15 cents a word for human translation, the huge savings are obvious.

Moreover, high quality translations by professional translators of difficult material may average only four to six pages a day – at times seriously delaying product (or regulatory) implementation, thus eroding market lead time of a new product. Such hidden delay costs will largely disappear in a SATS environment.

4

SATS will almost certainly lead to *a huge expansion of international tourism.* Within advanced countries, tourists will have no problem communicating and absorbing the local environment's messages through the use of universal 'one-way' SATS (translation of incoming messages). However, in

underdeveloped countries where SATS may be primitive or non-existent, 'two-way' SATS could be the solution. A possible scenario: at the local airport, each incoming tourist will be provided with a 'SATS set' – a small translation voice speaker-box with mini-microphone, plus a set of translation earphones. The tourist will go through his entire trip in that country talking in his native language, his voice being 'broadcast' through the box, instantaneously translated into the local dialect. The earphones, of course, will enable him (just like at home) to hear the natives in his own language while they speak in their local tongue. Science fiction? A 'portable speech translator' has been under development by Carnegie Mellon and Karlsruhe universities' Interactive Systems Labs since 1995 (Interactive Systems Labs, 1999b).[19]

5

At first thought, one might expect SATS to further reinforce the cinematic hegemony of 'Hollywood', for the resources at its disposal will enable its 'quality' (i.e. 'production value') films to be seen anywhere in the world without the added local cost of written translation or dubbing. Moreover, 'as films become entirely digital, software to match an actor's mouth movements to dialogue in a different language would come into its own. Such software already exists, and it's a fair bet it will get pretty good pretty quick' (Morton, 1999: 44). As the technology of synthetic voice is already well advanced, in the future most films will be cheaply and easily translated into the local language, with the (synthesized) voices of local stars dubbed in perfectly by automated means.

However, while Hollywood will almost certainly benefit (moderately; its international market penetration is already very high), this does not necessarily mean that the cinema of other nations will suffer. Quite the opposite: *SATS will open up vast markets* (including the native English-speaking one, the largest outside of China) *to all other national film and television productions*. As Morton notes in the context of ultimately perfect lip-synching technologies: 'When that happens, foreign-language films will be able to enjoy much wider releases within America' (1999: 44).

Indeed, even local theater productions in any language will be far more accessible to the SATS-equipped world at large. In short, through SATS we can look forward to a much higher level of cultural commerce for both the dominant Anglo-Saxon cinema/TV/theater as well as other 'periphery' producers.[20]

6

International migration bears brief analysis from an economic, and not just a political, perspective. Once SATS removes the linguistic barrier, *the mobile flow of (domestic or foreign) workers should increase* well beyond the large

numbers of today – especially among low-skilled, poorly educated workers whose English (or any other second language) skills are virtually non-existent.

The economic benefits for both sides are clear. The Third World unemployed will have greater opportunities to find gainful – and from their local salary perspective, relatively high paying – employment. The developed world, on the other hand, will attract laborers for jobs which their own local population is unwilling to carry out (hard, dangerous or boring work).

There is an alternate – not necessarily contradictory – scenario: Third World skilled workers in compunications employed by First World corporations, working in their own native land (e.g. Indian programmers writing code in Bombay for Silicon Valley companies). Here cyberspace SATS would be the critical element in such an economic marriage of convenience, by removing the final barrier to corporate communication (time and distance have already been negated by cyberspace). Such a general development would have the added advantage of avoiding the political problems which physical migration entails for the host country. In short, *SATS might well increase job mobility without the concomitant political complications* mentioned earlier.

Culture

1

The most immediate cultural effect of SATS will be on language itself. Negatively, once people stop learning, reading and hearing foreign languages, *the world's languages will by and large cease their 'cross-pollination'*. As Derrida puts it: 'each language is as if atrophied in its isolation. . . . Owing to translation . . . this linguistic supplementarity by which one language gives to another what it lacks, and gives it harmoniously, this crossing of languages assures the growth of languages' (1985: 193). As languages have always been enriched by foreign influences (English wouldn't have come into being had universal SATS existed in 'England' of the Middle Ages), SATS threatens to render languages far less dynamic in their etymological development.

Yet even in this, the situation is not altogether bleak. Linguistic cross-pollination will occur where SATS must translate from one culture a concept that does not exist in the other culture. There are two possibilities here. First, as Quentin Skinner suggests, when such a conceptual lacuna exists in one civilization, 'the possession of a concept will at least *standardly* be signalled by the employment of a corresponding term' (1988: 121). However, this is a problem over the long term, for two reasons: first, the 'corresponding term' usually cannot fully provide the essence or flavor of the original; second, in order to truly 'translate' the essence of the term, the

'corresponding term' enlarges to bulky awkwardness. At some point, when the general idea has been incorporated into the receiving culture, the second possibility becomes operative: its language will choose to 'import' the original term from the source language, thereby enriching the language.

On the other positive side, SATS should lead to *the retention and preservation of languages*, especially those *under present threat of extinction* due to a low population base and/or dominant language contiguity (e.g. Welsh, Romansh). The world today has between 5000–6000 languages. Of these, about 20–40 percent are already 'moribund' (no youth speak it) and half are under threat of extinction in the not-too-far-off future (Ostler, 1999). Indeed, only 200 languages have over a million native speakers. SATS might well be a last-minute savior for many truly ancient tongues.

2

The second outcome is a corollary of the first, but given its huge import it deserves special consideration – *the end of English-language dominance around the world*. This is a bold prediction. The world is awash in English, and its hegemony seems to be expanding and strengthening. In the European Union it has already become the *de facto* continental-regional language. No less an authority than Sridath Rampal, co-chair of the Commission on Global Governance, declared back in 1985 that 'there is no retreat from English as the world language; no retreat from an English-speaking world' (Crystal, 1997: 20).

However, history has shown us that the lingua franca of any era usually begins its demise when least expected – either because of political decline (the end of empire) or for technological reasons (e.g. the invention of print ended the dominance of Latin in the western world, by enabling the quick spread of local vernacular). Much the same thing can – and probably will – happen to English as a result of SATS, for the logic of universal translation ineluctably leads in the direction of native language domination despite (and because of) SATS-strengthened globalization. Other than its snob/status appeal, why would people in a universal SATS environment break their teeth trying to learn a foreign language – especially English, by all accounts not one of the easier or more syntactically logical tongues on the face of the Earth?

The question, then, is essentially one of timing: will English linguistic hegemony become irreversible before SATS becomes entrenched? Many experts seem to agree that SATS is not a distant dream. For example, one major Delphi survey in 1996 involved 45 futurists and technical experts who predicted that quick and accurate machine language translation would become routine by 2012 (Halal et al., 1997). Another serious source predicts the introduction of a portable, simple-conversation translation device by 2007 (Pearson, 1998). With English spoken as a mother tongue by only

about 10 percent of the world's population today, it is difficult to see English 'overwhelming the world' (Crystal, 1997) in the coming two decades, especially given the slow but inexorable rise of the Pacific Rim (China, Japan, Korea) and the reemergence of local, ethno-nationalism as a political force in parts of the western world (Scotland, the Balkans, Catalonia, etc.). By then, SATS should be well on its way to turning the tide against English.

As a result, the deeply felt fears of the non-English speaking world should abate in a universal SATS environment. The following quote taken from the inaugural volume of this journal, is representative of such widespread concern: 'Will the development of English on the internet destructively replace any indigenous communication? . . . Does English, as the dominant language, broadcast a particular dominant culture?' (Kramarae, 1999: 48).[21] While such questions are interesting and important in the short-to-medium term, SATS will render them irrelevant in the long run.

3

The final ramification of SATS is the most profound of all: possibly, *the homogenization of world ideology and values*. This is a relatively precarious prediction, because obviously some earlier comments lead us in a direction of greater ideological diversity. Indeed, we might witness a paradox of sorts – along with local linguistic preservation, SATS could well maintain and perhaps even enrich the diversity of culture (texts, fashion, religious rites, song, etc.) while at the same time bringing the world closer together in a more fundamental normative fashion. As macro- and micro-communication increases around the globe, over time we might well come to understand – and perhaps also internalize – each other's values and norms.

Should this occur, even to a limited extent, the effects will be dramatic, for, as suggested soon after the end of the Second World War: 'Mutual understanding and peaceful relations among the peoples of the earth have been impeded not only by a multiplicity of languages but to an even greater degree by differences in patterns of thought' (Pribram, 1949: 1). Through SATS, external-*objective* cultural diversity could be maintained while internal-*subjective* value differences could be reduced.

For example, it is no coincidence that the age of mass media has led to the almost universal acceptance (at least declared) of such ideas as 'democracy', 'civil rights', 'freedom', etc. The SATS-enhanced ability of everyone to see, hear and understand what others have to say and what they believe in, might push the world's different 'clashing civilizations' (Huntington, 1996) towards greater consensus on the key ideas and values of the 21st century (not necessarily only those of the west). In other words, SATS-induced linguistic diversity (the 'power of babble') can aid in local culture retention, given that language is the central glue holding the entire

local culture together; if the language is retained, so too will the other cultural accouterments. At the same time and on the other hand, the SATS-enhanced ability for universal substantive communication (the Tower of Babel) might bridge gaps of ideological disagreement through a synthesis of different *Weltanschauungen.*

CONCLUSION

The underlying question of this article is whether SATS is a centrifugal factor fractionating the world or a centripetal force binding the various world cultures closer together. The tentative answer is that overall *both trends could well occur simultaneously,* each actually feeding the other. While we gradually evolve a SATS world of universal substantive communication (the Tower of Babel), SATS will paradoxically also preserve and even expand linguistic (and to a certain extent more broadly cultural) diversity (the 'power of babble').

In short, as opposed to the biblical story, this time around the 'babble' will not be mostly a divisive factor but rather a unifying one – reinforcing the other major post-industrial, information age factors such as mass media (e.g. CNN, internet), transnational organizations (e.g. World Bank), interdependent world problems (e.g. Treaty of the Seas), international migration (e.g. *Gästarbeiter),* and the like, which are inexorably leading us to greater regional and world integration. On the other hand, the totalitarian, monolithic impetus of Babel will not exist either, for SATS has a profound diversifying tendency, enabling each culture to preserve its identity.

Nevertheless, it is doubtful that we will arrive at this equilibrium without turmoil in the world's political, economic and cultural systems. Although mostly beneficial in the long run, the SATS revolution will be a profound one. We would do well to view it as such and not as merely another technological marvel in the ever-growing panoply of 'gee-whiz' compunication devices of the cyber-world and beyond.

Notes

1 The standard term used is MT (machine translation). However, SATS is preferable because we no longer use 'dedicated', stand-alone translation machines, but rather computer programs which will evolve into global cyber-'systems'.

2 Even humans do not always pronounce a word correctly; bad spelling is widespread and 'tolerated' within limits; many people are 'experts' at making malapropisms; and so on. Thus, a SATS with a 99.8 percent success rate (two mistakes every thousand words) is equivalent to 'fully correct translation' for we need not expect it to do better than ourselves.

3 The field is truly vast. A good place to start is Cole et al., 1996. All citations below from this internet source will list the sub-chapter and 'page number', based on a printout on quarto paper.

4 For an exhaustive description of NVC components which the translator must pick up on during oral/visual translation, see Poyatos, 1997. Some of the more

important ones are: audible kinesics (e.g. impatient finger rapping), proxemics (distance between speakers) and dermal (e.g. blushing) and chemical (e.g. tearing, sweating) reactions.

5 For a useful, if somewhat 'tongue in cheek', critique of translation technologies on the market today, see Budiansky, 1998.

6 For a systematic review of speech recognition products and their respective strengths/weaknesses, see Fulton, 2000.

7 Download from http://babelfish.altavista.com

8 See, for example, the University of Geneva's Translation and Interpretation Department's site: www.issco.unige.ch/resources/Linguistics/tao-angl.html. Although a bit outdated, see too Pugh, 1992.

9 For a good overview of future developments in this area, see Arnold et al., 1994: ch. 10 ('New Directions in MT'). The entire work can be downloaded from http://clwww.essex.ac.uk/~doug/book/book.html

10 The use of computer architecture modeled on the human brain is already opening up intriguing possibilities within our subject. For example, in order to sharpen speech recognition, Interactive Systems Labs is developing a neural network lip reader in order to improve the recognition rate in difficult circumstances (e.g. cross-talking). See http://www.is.cs.cmu.edu/ISL.multimodal.lips.html

11 One of the founders of cybernetics, Alan Turing, proposed a simple test in order to decide when a machine is 'intelligent': place a person in one room and enable him to ask any question he wishes of the 'X' in an adjoining room. If at the end (this can go on for hours or days), the person cannot tell if 'X' is a human or a machine, the test is passed.

12 For example, the Pangloss Mark III which is being developed at three US universities, employs three 'translation engines': Knowledge Based, Example Based, and Lexical Transfer. These are integrated for the best overall output (Pangloss, 1999).

13 As we already have a very good picture of where computer chip technology and capabilities are headed over the next decade, it is obvious that Moore's Law will still be valid for at least another ten years – leading to incredible computer power by the year 2010.

14 People will be wearing one of these throughout the day in any case for other purposes: watching TV while walking in the street; working on their 'computer' while jogging; video-phoning while driving. In other words, such media-by-sight paraphernalia will be standard, every-day communication aids; SATS will merely add to their multi-functionality.

15 This field is vast and an in-depth discussion would lead us far afield. For a general analysis, see Cooper, 1989; for an example of language planning on the local-national level, see Davis, 1994.

16 Japan's prime minister responded to the American ultimatum for unconditional surrender by announcing that his government would '*mokusatsu*' the demand. The word has two meanings: 'to consider' and 'to take no notice'. Japan's own English-language translators chose the latter usage; the world heard that the Japanese had *rejected* the American ultimatum rather than that it was *being considered*. Hiroshima followed.

17 This belief is not universal. Douglas Adams in his bestselling *The Hitchhiker's Guide to the Galaxy* suggests that universal language translation ('Bablefish') would be the single greatest cause of wars in all of (future) history – once people *truly* understand each other, tolerance would die.

18 Foreign-language education would remain an academic niche discipline, because of the need for intercultural and foreign culture scholars to know first hand the language of the civilization which they are researching.

19 The 'portable speech translator' mentioned above is designed to do the following, as the Interactive Systems Labs site notes: 'Presentation of the translation output can be provided acoustically by synthetic speech in the target language, or by a heads-up display that shows subtitles under the face of the other conversant. . . . [It] has built-in databases with maps and local information (e.g. about hotels and transportation). . . . The system is also environmentally aware: using an integrated GPS system to localize the user and by analyzing the background noise, the system knows what level of communication is appropriate in a given situation.'

20 For a discussion of the problems of film and theater translation, see: Varela (1997: 315–26); Zababeascoa (1997: 327–42); and Weale (1997: 308–9).

21 To her credit, Ms Kramarae does note that speech recognition and machine translation technologies 'could lessen some of the difficulties of intercultural communication' (1999: 49). However, she refuses to draw the conclusion to its logical end, arguing (without explanation) that 'fully automatic translation will, probably, never be possible' (1999: 50).

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