Kobayashi's Dream

by Dr. Herbert R.J. Grosch

A dream we all share is the centerpiece of my old friend Arthur Clark's two movie scenarios: a computer you can interact with in complex, unfettered English. One with a friendly voice; one you can reason with; one that knows what is happening in your area of mutual interest without being explicitly informed; one that works tirelessly and effectively while you sleep.

Another dream we all share is that of the chairman of Nippon Electric, Koji Kobayashi: to be able to call him in Tokyo and talk in English, and his computerphone will translate without delay into flawless Japanese. And the reverse, of course.

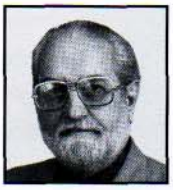
Where do we stand? Well, in a very few installations we have the friendly voice — strictly formatted, not artificially intelligent. The rest, no. Will we have a HAL by 2001? By 2010? In fifty years? Will we ever achieve Dr. Kobayashi's dream?

I was at the seminal conference on machine translation at MIT back in vacuum tube days. Fred Thompson had me brought back from Europe to take over his DEACON (Direct English Access and CONtrol) project in 1965. I wanted these good things to happen in the Fifties and Sixties. I still want them to happen, even it takes a century. But they are by far the most difficult tasks computer people have ever tackled. Make the problems of SDI looks easy!

It isn't the hardware. The machines are great, and still getting faster and more capacious and cheaper. We get a thousand times as much bang for a buck with VLSI as with those funny hot old bottles. There is no end in sight; when the dawdling speed of light and the dull restrictions of heat transfer hold back chip advances, weird new architectures will take over.

Consider multi-processing — the kind where each processor chip can do a fancy job, not where there are 1024 identical serial-by-bit adders on each substrate. We could put one processor chip to work on each paragraph of a translation. Same program, running asynchronously, of course. Under human command, we might even run through a second time, like a two-pass compiler, to allow for interparagraph context contributions. One gigantic terabyte of memory, one fancy laser printer, one work station with a fast document reader, a hundred identical processor chips — oh, and one power supply! Not cheap, especially not now in the Primitive Late Eighties — but wait a few years.

There are two approaches to the central problems. The happy one, the one the dreamers tell us about in private conversations and DARPA proposals, I call the Piaget method. Kids learn to talk and understand — talk first, as I remember — by immersion in the culture. Why not immerse the natural language computer in vast quantities of text, and (ahem) encourage it to learn? Put that way, it sounds crazy, doesn't it? Well, it is. Unless the program furnished by humans to encourage the machine to learn on its own is as sophisticated as the mental processes of the adults and peers that kids rub up against, it won't work.



Dr. Grosch is a computer pioneer still active at the policy level. He was the first manager of IBM's space program, has worked twice for GE, and twice for the US government — most recently as director of the Bureau of Standards institute which attempted to improve the effectiveness of government data processing. He lives and works in Europe, and consults for companies there, in North America and Japan.

The other method is sheer hard work: to slowly and carefully build a bridge across the gulf between human and machine language, cantilevered out from our side, redesigned over and over again as deeper insights into human language and more powerful linguistic methodology become available.

The two dreams need the same tool. To write a long and complicated computer program starting with unrestricted natural language, or to translate from one human language to another, requires only that that gulf be bridged. English to FORTRAN, or English to zeros-and-ones to Japanese, are the same.

There is one ancillary problem of great current interest, and that is voice recognition. Can we get the chairman of the board to work on a computer if he can talk at it instead of type on it? No, I think not, and I say that even though President Betancur of Colombia had a Wang on his desk when I was in Bogota. It's a problem of corporate cultures; execs want answers to unformatted questions, and until we have HAL, the computer needs carefully thought-out inputs.

For lower level uses the technical problem is blurred by economics. It will always, repeat always, be cheaper for an expert data entry operator to input coding or data than to have an expensive analyst or accountant fumble with a head cold, and voiced verification, and especially voiced correction. And those two jobs of program and data entry are much easier than producing an attractive business letter.

Voice input is already working at specialized tasks. It will be available for natural language tasks such as translation (where the perfection of program and data entry, and the elegance of business correspondence, are not necessary). Its future is assured — but not for everyday tasks.

Think of the typical learning curve: a slow start, a linear rise, a tapering improvement — automobile engines, for example. In my view, natural language processing has not gotten anywhere near the long-rise part of the curve.

We will not have a HAL in 2001, or in 2010 either. I doubt whether we will have even non-sentient, non-intelligent unrestricted English input to our computer systems by those dates. We may have the latter in 50 years, and that might permit Dr. Kobayashi's dream — far too late for him to benefit. For his computerphone, only performance as good as the typical human translator is required, not perfection.

We will never have really satisfying interactions with our computers until they understand us; our understanding them, which is pretty wonderful in itself, is clearly not enough. Throwing Pentagon money at the problems is a bad idea. Long and deep support by IBM, DEC and Unisys, and NEC and Fujitsu and Philips, is what is needed — in house, contracted out to bright little companies, and supported in good universities around the world. But, gentle reader, don't hold your breath. It'll be a while.<<