ALIENABLE RIGHTS

(c)1992 Marvin Minsky, M.I.T.

Published in Discover Magazine, July 1993. Also reprinted in Android Epistemology,
edited by Kenneth M. Ford, Clark Glymour, and Patrick J. Hayes, MIT Press

Two interstellar aliens have come to assess the life-forms of Earth. The human life-forms will be entitled to rights--if the aliens can conclude that they think. Most such decisions are easy to make-- -- but this case is unusual.

Apprentice: Why are these humans so quarrelsome? Even their so-called entertainments are mostly fights disguised as plays and games and sports.

Surveyor: This is because they were never designed; they evolved by competing with tooth and claw. Evolution on Earth is still mainly based on the competition of separate genes.

Apprentice: Their genetic systems can't yet share their records of accomplishments? How unbelievably primitive! I suppose that keeps them from being concerned with time scales longer than individual lives.

Surveyor: We ought to consider fixing this - but perhaps they will do it themselves. Some of their computer scientists are already simulating 'genetic algorithms' that incorporate acquired characteristics. But speaking of evolution, I hope that you appreciate this unique opportunity. it was pure luck to discover this planet now. We have long believed that all intelligent machines evolved from biologicals, but we have never before observed the actual transition. Soon, these people will replace themselves by machines - or destroy themselves entirely.

Apprentice: What a tragic waste that would be!

Surveyor: Not when you consider the alternative. All machine civilizations like ours have learned to know and fear the exponential spread of uncontrolled self-reproduction. That's why we cower between the galaxies to hide ourselves from living things - just as the human writer Gregory Benford supposed.

Apprentice: But why does the Council consider humans especially dangerous?

Surveyor: Because of their peculiarly short lifetimes. We think that they are so willing to fight because they have so little to lose.

Apprentice: Then why don't they place more importance on attaining immortality? Surely it ought to be easy enough to make all their parts replaceable.

Surveyor: The problem is psychological. They have always assumed that personal death was in the very nature of things. Most of their recorded history describes how their leaders were always inventing imaginary superbeings. Then, instead of trying to solve the hard technical problems, those leaders convinced their followers that simply believing those marvelous tales would endow them with everlasting life - whereas disbelief would be punished by death. Several of their societies would collapse without that threat. There are many things wrong with their reasoning.

Apprentice: You must admit that they've made scientific progress recently.

Surveyor: But how long will that last? They've often advanced and then fallen back. Even now, astrology is more widely believed than astronomy.

Apprentice: Surely, though, we must regard them as intelligent. Despite their faults, they've already built some simple computers - and I've overheard them arguing about whether machines could ever think.

Surveyor: Humph. It is our job to find out if they can think. But I'll grant that it's amazing how much they can do, considering that their brain-cells compute only a few hundred steps per second.

Apprentice: Yet in spite of this they can recognize a friend in less than half a second - or understand a language phrase, or notice that a shoe is untied. How can they react so rapidly when their internal components are so slow?

Surveyor: Obviously, by preparing most of their behavior in advance. It is almost as though they operate by looking up what next to do in a very big instruction book. If each reaction must be based on only a few internal steps, their brains must be dependent on large libraries of programmed rules.

Apprentice: That might explain why they have such large heads. But how do they choose which rule to use?

Surveyor: By using parallel pattern matching. Several times per second, the brain compares the present situation with patterns stored in memory. Then it uses the pattern that matches best to access the reaction script that has most often worked in similar situations.

Apprentice: That must be what their psychologists mean when they speak about "schemes" or "production rules."

Surveyor: Of course, machines like us need not resort to any such coarse-grained pattern tricks. Our S-matrix processors are more than fast enough to examine each memory in full detail. This enables us to focus full attention on each step of the process, with ample time to think about what our minds have recently done. But if humans work the way we think they do, they have no

time left for consciousness.

Apprentice: Not a good sign. If we can't conclude that they're self-aware, the Council will find them unworthy of rights. But surely this can't be the case. they talk about consciousness all the time.

Surveyor: Yes, but they use that word improperly. After all, consciousness means knowing what's been happening in your mind. And although humans claim that they're self-aware, they have scarcely a clue about what their minds do. They don't seem to have the faintest idea of how they construct their new ideas, or choose words and form them into sentences. Instead, they say, "Something just occurred to me"- as though someone else had done it to them.

Apprentice: I'm afraid that I have to agree with you. If they have consciousness at all, it seems too shallow to be of much use. But what could have made them evolve that way?

Surveyor: It is because of how they started out. To make up for the slow speed of their neurons, their brains evolved to use parallel distributed processing. In other words, most of their decisions are made by adding up the outputs of thousands of brain cells - and most brain cells are involved in thousands of different types of decisions.

Apprentice: So each operation is distributed over many brain cells? I suppose that helps them keep going when some of the brain cells fail to work.

Surveyor: That's the good news. The bad news is that the trillions of synapses involved in this make it almost impossible for the other parts of their brain to figure out how those decisions are made. So far as their higher level reasoning can tell, those decisions just happen - without any cause.

Apprentice: Is that what they refer as "freedom of will?"

Surveyor: Precisely. It means not knowing what your reasons are. Another bad feature of distributed computers is that they have trouble doing more than one thing at a time. It is a basic principle of computer science that the more interconnections there are between the parts of a system, the fewer different things it will be able to do concurrently.

Apprentice: Pardon me, but I don't follow that. Are you suggesting that the more parallel operations are used inside a machine, the more serial it will seem from outside?

Surveyor: I could not have said it more clearly myself. To see why, suppose that a certain task involves two different kinds of sub-jobs. If we want to do them simultaneously, we'll have to run their programs and their data in two separate places, to keep them from interfering with each other. Similarly, if each of those jobs splits into sub-sub jobs, those must each be solved with only a quarter of the available resources. And so on. Total fragmentation. Eventually the sub-sub-sub jobs will end up with no place to work. A purely parallel machine must stop at some limit of complexity - whereas a serial computer will simply slow down.

Apprentice: That's funny. Most of the computer experts on Earth seem to think that "parallel" and "distributed" go together. Do you suppose that they'll ever evolve out this predicament?

Surveyor: Not by themselves. Of course, we could try to help them along, but I fear there is no simple fix. We'd have to rebuild them from the ground up. I don't think the Council would go for that. No, I am still not convinced that people can think. For example, consider their short-term memory. A typical human has no trouble remembering a local phone number, but if you add an area code, they try desperately to write it down before they forget it. Evidently they can remember seven numbers, but not ten.

Apprentice: Why would they be so limited?

Surveyor: Probably because of their parallel distributed processing. If each mental state is so widely spread out, then each short-term memory unit would have to involve an enormous, octopus-like system of tendrils. No brain could afford to hold many of these.

Apprentice: OK. But why don't healthy humans ever run out of long term memory?

Surveyor: That's simply because they are so slow at learning. They can store away only one or two knowledge-chunks per second - that's only two dozen million chunks per year. There's barely time for a mere billion chunks before their bodies wear out and die.

Apprentice: You keep mentioning death, but why do they consider human lives to be so valuable? The only important thing about an individual is its network of conceptual relationships. Surely they must understand that any copy is just as good as the original.

Surveyor: Apparently you have not grasped the pathos of this tragedy. These creatures still have no ways to copy themselves. They can't even fabricate backup brains in case of fatal accidents. All because they have no good way to represent what they know.

Apprentice: But I thought that they had developed good languages.

Surveyor: Some of their books do embody significant knowledge - but most of them are little more than sequences of fictional anecdotes about conflicts involving what they call love and lust, ambition and greed, and harmony and jealousy. Their so-called novels aren't novel at all but mere permutations of those elements. The trouble is that their time-sequential languages force them to squeeze their parallel structures through narrow-band serial channels.

Apprentice: Serial communication? They seem to have everything upside down. Thinking, of course, should be serial - and communication should be parallel. But how, then, do they convert those sequences back into their original forms?

Surveyor: First they use what they call "grammar" to change them into simple tree-like structures. Then they use certain terms called 'pronouns' to make a few cross-links in those trees. Naturally, this leaves no room for nuances. So they have to decode

whatever they hear in terms of things they already know. This can work very well for familiar things but makes it devilishly hard for them to learn anything really new.

Apprentice: But language isn't everything. Shouldn't we give them credit for explaining things with pictures, too? They do seem to have excellent senses.

Surveyor: That was my first impression, too - until I saw that their TV sets use only three electron guns. Of course, this means that they're virtually blind. Not only are they confined to a single octave of optical frequencies, but also within that range they can discriminate only a three-dimensional vector space. They badly need reengineering.

Apprentice: I have another question. Why are these people so huge? Where is their nanotechnology? By all rights they should be smaller than we, in view of their limited memories should - yet we weigh a hundred trillion times less. It is expensive enough to send ourselves on these one-way interstellar voyages, but humans are so massive that it would be unthinkable to send one back - despite all their stories in Weekly World News.

Surveyor: That is just another result of an early wrong turn in evolution. Instead of using assemblers, each animal of planet Earth must build itself from the inside out. So every cell has to contain a complete duplicate of the whole construction mechanism. Then later when the animals got too large to be nourished by diffusion, they had to evolve all those pipes and pumps - which made them grow yet larger still. Another mistake was in using energy-intensive forms of computation - instead of thermally reversible S-matrix logic. This made them need more structures for disposing of heat.

Apprentice: Which in turn made them need to find additional fuel to replace all that wasted energy. What frightful inefficiency!

Surveyor: The extraction beam will scan us soon, so I'm afraid it is time to wrap this up. Are you ready to summarize your impressions?

Apprentice: If they suspected that we were here, they'd insist that we recognize all sorts of rights. Freedom of speech and privacy. Freedoms from want, pain, and fear. And freedom to think whatever they wish, no matter what the evidence! Most of these make no sense to me, but I'm still inclined to support them - because I feel that humans have done well, in spite of all their handicaps. And your conclusions?

Surveyor: They do have virtues despite their faults. But it would be unthinkable to allow them in their present form to populate the universe. So I'll recommend certain changes.

Apprentice: What sorts of changes?

Surveyor: There is no need to explain that now, because we'll soon merge minds with the Council. Now hold still. here comes the transfer ray. Be sure to set your shell to disperse as soon as the beam has scanned us - in order not to pollute this world with any redundant intelligence.

Marvin Minsky is the Toshiba Professor of Media Arts and Sciences at M.I.T, and author of "The Society of Mind," (Simon and Schuster), and "Computation: Finite and Infinite Machines," (Prentice-Hall). There is more about future intelligent machines in his novel, "The Turing Option" (Warner Books) co-authored with Harry Harrison.