

ARE THINKING MACHINES POSSIBLE?

By Sébastien Markley

Siegfried: I've been thinking about our science fair project, Roy.

Roy: Are you still stuck on cloning headless humans?

Siegfried: No, actually, it's much more ambitious than that... I want to create human consciousness... out of a machine!

Roy: Hubris.

Siegfried: Women have been able to create human beings out of their wombs for all of history. Now it's our turn. It's time that men get a chance to create life as well. Only this time, we will be creating humans with our hands and intellect, through the application of our rationality. These humans shall not be made out of flesh, they shall be made of metal and plastic; they shall be creatures that could never arise in nature. Not limited by genomes, or fatigue, or anxiety as we are and ever shall be, they shall be machines capable of having their fundamental natures improved at will, and eventually, they shall be self-improving. Our society and technology changes at fantastic rates, yet we cannot improve our essential physical, or even moral nature due to the fact that new genes take thousands of years to evolve. Can you imagine how quickly species shall advance when actual evolution occurs at the rate that technology progresses?

Roy: Interesting idea, Frankenstein, but I don't think it possible. You can make clever machines, machines which can even outplay the greatest chess players in the world. However, none will ever be conscious as we are and even if that were the case it will be impossible for us to construct one. Our consciousness is the essence of our being; it cannot be created by hands, nor can it be reduced by us to simplistic natural laws. A machine, on the other hand, is always limited to doing the actions that its engineer designed it for.

Siegfried: Metaphysical nonsense! Our minds are nothing but the interaction of the components of our material selves. Alter our material selves, we alter our mental selves. Destroy our material selves, we destroy our mental selves. Create a material being, and you create a new mental entity. If you want to create a human consciousness, all you need to do is create an object that in all

physical ways resembles a human being, and you shall have a human mind to go with it.

Roy: That seems to imply that any thought I am having right now is simply atoms moving around within my head?

Siegfried: Yes.

Roy: Well, I can't accept that.

Siegfried: We'll deal with your limitations later. For now, think about this. Imagine I was able to take every single cell in your body, replicate them and then construct another body. This body would be designed so that the moment the creature is completed, it resembles you at a certain moment in your life in every respect. Thus, it would have your posture, your body temperature, and even the very positions and velocities of the atoms, which make up the electrochemical interactions in your brain, would be the same. I do not even have to argue about whether this creature would have exactly the same memories and thoughts that you had when the cloning took place. Would you not at least admit that this is other being who acts and is indistinguishable from you, has a consciousness?

Roy: I suppose so.

Siegfried: You had better suppose so. You are conscious and this new person has exactly the same interactions occurring in its brain, and the rest of its body. If you denied my claims, then you would allow for the existence of people just like you and me who live their lives in the world just as anyone else does, down to their explicitly stated religious, aesthetic and philosophical standpoints just as anyone else does, but yet have no consciousness. It cannot be merely the fact that a person has not been squeezed out of a woman's uterus that rules out its capability of retaining consciousness. Thus, people could be born every day without a consciousness and we would never be able to realize it. This is certainly not logically impossible, but it is at least absurd. I am willing to acknowledge that you, Roy might be nothing but a clever automaton, but this is silly.

Roy: Get to the point! If you are trying to establish that this clone of mine is conscious, I'll give in for now.

Siegfried: Okay then. What if your clone was in every way exactly the same as you, except that it was missing a hair follicle. Would that be any less conscious than the original clone?

Roy: No

Siegfried: What if you were missing a whole limb, such as an arm?

Roy: Still no, consciousness is not in the arm, it's in the head.

Siegfried: You can see where I am going. I can continue making new, living clones of you and eliminating parts of their bodies, while still not eliminating their consciousness until we find the material parts of their bodies that are essential for their consciousnesses. What are we left with?

Roy: Perhaps nothing. Who's to say that we need to be materially embodied to have consciousness?

Siegfried: Pyramidiot! We have breaks in the continuity of experience all the time, through sleep, fainting, or other losses of consciousness and they all correspond to a parallel effect on a human body. We cannot have direct sensory experiences which are unconnected with the human body.

Roy: What about astrotravel, clairvoyance and telepathy?

Siegfried: I shall pretend I did not hear such cretinous, pseudo-scientific claims coming from you. I know you don't really believe in it. Anyway, I asked you what parts of the body were essential for consciousness.

Roy: Well, the brain, nervous system, and our sensory organs, I presume... I see where you are going with this (and I'm not just talking about the aforementioned headless human clones), but you haven't improved your case at all. Whether the human body is incidental or not, doesn't make the human brain any easier to create, let alone demonstrate the possibility of creating a new human mind!

Siegfried: Let me finish... What are our brains made up of?

Roy: Neurons, of course.

Siegfried: Yes! Long, spaghetti-like cells, which interact with each other by exchanging chemicals. Let's say you could remove one such cell from our brain and replace it with a tiny synthetic device equipped with a storage of exactly the same chemicals our brain uses, and that interacts with the other brain cells in exactly the same way as the old neuron did. Replace one neuron (let's say you could do it instantly and without affecting any surrounding

cells), and from the perspective of the other neurons, nothing at all has changed, am I right?

Roy: ...

Siegfried: Replace another, and from the perspective of all the 'natural' neurons, nothing has changed. We can go on replacing every single neuron in our brain in such a manner and we would be left with a creature who would talk and act as if nothing at all was different about him, even though, by any reasonable definition, it is a machine! As to all nerves leading from the brain to the rest of the body, there is nothing different about what is happening upstairs. The only way one could tell that the subject had become a cyborg would be to slice off the top of his skull and see inside!

Roy: You're talking about the impossible, there is no way one can replace neurons with artificial objects and leave the brain indistinguishable. Metal, when placed in the cerebral fluid, especially when we are dealing with such tiny space would have to effect the saline balance.

Siegfried: This is a thought experiment. Quit haggling over irrelevancies. Now, you can at least admit of the possibility that such technology could exist in the future. Besides, the cyber-neurons don't have to be exact individual matches. They would just have to behave in the same way human neurons do in that if they don't exactly resemble the subject's neurons, they at least act the same way as some neurons and the thought experiment would still hold.

Anyway, the point I want to make is this: where does the consciousness lie? While we are replacing the neurons in the subject's brain one by one, when does the human being cease to be a conscious being and become an automaton? Surely not after replacing only one neuron out of millions. In fact, it is well known that the human brain can continue to function normally, even when half of it has been removed! So we can confidently replace half of a subjects brain without fearing loss of the subject's consciousness. Does one need a third of a brain? A fifth? Or does simply having one single natural neuron in a synthetic brain give the entire organ a consciousness? As I said before, the person who had this operation would still have the same memories and would respond to questions such as "are you still conscious" the same way as he would before the operation no matter how many cells are replaced.

This is because the neural relations inside his brain remain intact. Where is consciousness then? Inside each and every neuron in the brain? Or is it somehow a reflection of the interactions between all the different neurons? Humans lose brain cells all the time without feeling any changes in their consciousness or awareness, and as I said before, the brain can adjust to enormous losses of neurons, so surely it cannot be the first case. Yet if it is not, then if one replaces all the individual neurons with artificial ones, the interactions between the artificial ones are *exactly the same* as the interactions between the "natural" ones. So if consciousness arises from neuron interaction, then such an artificial brain has consciousness!

Roy: What a ridiculous hypothesis. 'If one can replace one neuron with a tiny metal robot that functions exactly the same way as a neuron and can be replaced without it affecting the patient...' You presuppose that all chemical reactions within one's brain can be exactly determined by science, or at least measured by science in making this claim. Anyone can see that this sort of precision is impossible considering the terrible crudeness of our technology and the infinite time and energy required to analyze the data. Not only that, but it's been known for decades that this sort of precision is completely ruled out by such things as the Heisenberg Uncertainty Principle which says that it is impossible to know qualities of the universe exactly. We are infinite beings, and we require more than infinite minds to be able to understand us completely and make perfect copies of us. One might as well describe the entire universe before one can embark on encapsulating exactly all the intricacies and subtleties of a human character. As I've said many times before, we cannot be reduced to natural laws. The essence of a human being is its indeterminacy and that places it outside of scientific understanding.

Siegfried: Well, I disagree with you on that point as well. If you cannot accept my Ship of Theseus style reconstruction of a person, let's look at it a different way. Suppose now that I were able to create a robot that passed the Turing test; that is, when presented with a set of questions, the robot would respond in such a way that no one could possibly tell that the answers given were not given by a human at all. Would you not say such a machine would be conscious?

Roy: Not at all! Once again you are imagining the impossible, but even in your precocious thought-experiment, you cannot seal your case. All one needs to do to pass the Turing test is come up with a list of possible questions, and make a recording of the most likely human response to such questions. Such an undertaking would take countless hours and probably thousands of humans to search out possible questions, and answer them (most questions will require many answers) and record them, but it is still logically possible if I swallow the premise of your argument. Then, any human being, asking a finite number of questions would get satisfactory answers (after all, it wouldn't take much to fool the average Canadian dolt.) However, the computer is not thinking. It is merely issuing a response to a stimulus. In fact in this case, the computer is doing nothing more than what a jukebox does when it selects the right disc, pulls it out and plays it.

Siegfried: But such a hypothesis presupposes a certain predictability on a human's part. Didn't you just say that humans couldn't be reduced to natural laws?

Roy: Yes I did. As I said, it is impossible. However, I have just demonstrated how even if it were possible, it doesn't mean that such robots have consciousness.

Siegfried: You're simply being dogmatic. As I said before, if you won't accept that the Turing test is a test of consciousness, then you have no reason to believe anything is conscious. In that case, your declaring humans to be conscious, and androids not is purely arbitrary. You can use the same reasoning to fall into the absurdity of declaring that any human being can be without consciousness without it ever becoming apparent to others.

Your problem is that you think that the human brain is something special or mystical. Can't you see that the belief that we have a consciousness has been programmed into our psyches? You can certainly be aware of the activity of thought in your brain. You are aware of this in the same way that a computer is aware that a disc drive is hooked up to it. Can't you see that the brain, a natural computer, gets the data it obtains from the senses mixed up with the data it gets from the sensation of its own activity? This sort of self-perception, because it is paralleled with external perception causes the human mind to believe that it can perceive itself as something which transcends the

body. If one actually looks at the close relation between what our minds perceive through self-perception and what we can see through external material evidence, considering the overwhelming correlation between physical events and mental ones, the clearest explanation for sensation is that it is materially based.

Roy: Now who is deluded? Are you saying that my awareness of myself, my feeling that I am a continuous, reasoning being is mere illusion? You are totally mistaken. Just because computers can carry out some operations that human minds do doesn't make human minds reflections of computers. Listen. There is an unbridgeable gulf between humans and machines. The reason is that a human being makes its decisions independently. As much as you can prattle on about childhood influences and the like, humans are not programs which run off of input.

Siegfried: What about brainwashing, torture, and indoctrination?

Roy: Shut up. We are beings that can create our own existential conditions, we can react to situations any way we like, and we do.

Siegfried: Ah, the illusion of complexity. It has got you believing in such nonsense as free will. You are stuck on the idea of humans being unpredictable. This may be so, but it doesn't mean that human minds are not regulated by simple, natural laws. What seems like independent thought and action may be nothing more than deterministic chaos. We have a host of neurons in our brains, which do nothing more than pass on simple chemical signals from one to another. These neurons and their interactions, with time may be understood and replicated. The complexity in our brains arises when billions of such neurons are arranged, and the signals begin to form patterns of infinite complexity. If you look at our actual characters, you can see that these are also ruled by the most simplistic of laws: the need for self-preservation, the desire for procreation. When combined with the interactions with the other people in our lives, it also forms patterns of action and thought of infinite complexity. After all, we see this sort of complexity arising from simple systems everywhere in nature. We can already imitate it with the computer program sometimes called "Life." It has a square grid of varying size and to which apply simple rules that determine the colour of each square depending on the colour of surrounding squares. With these basic rules, we

can create enormously complicated patterns that grow, subside, balance out into equilibrium, form repetitive patterns, or just exist as a jumbled mess. So, can any human being's character be exactly replicated? Probably not. Will we be able to predict all human behaviour through natural laws? Probably not. However, this complexity arising from interconnected simple systems shows that creating such a complex being is not difficult, provided we understand the basics of the being's structure. Neural networks, and von Neuman machines are ways of creating complex beings or systems without explicit human design. Like chemists experimenting with crystall

Leaving the general ideas behind, how does this apply to computer intelligence? Well, there may not be much to a human mind to imitate after all. We can merely think of it as a sort of computer whose activities, or its own calculations is actually affected by earlier calculations, and who is capable of storing and accessing records of its former "mental" activities. Consciousness arises from increases in complexity, greater facility with which the computer creates neural pathways, and more efficient analysis of input data and stored memory. Just as there is a continuum of development between the least complex animals and us, there is a continuum in the level of consciousness of each of these animals which corresponds to how well their brains are developed. Many animals can pass certain basic tests for consciousness while others can't. And there are many tests for consciousness that certain humans cannot pass. As computers develop, they will move along a similar continuum until they achieve consciousness and move beyond. Differences remain between biological evolution and machine evolution. Computers began as pure calculating machines and in the future, they may gain the ability to make ethical and moral decisions, and then have feelings. Animals began with basic instincts, then developed feelings, then ethical and moral decisions, and finally the ability to form abstractions and make calculations. Perhaps, in the future, the two processes of evolution, both going in opposite directions will meet and form a new being: A being which combines the product of life, and organic evolution with the product of pure laws, and reason; A being which will be so much greater than anything before it!

Roy: Are you sure this new being will not simply crush humanity out of existence and then, through its own stupidity doom itself to mass self-destruction? Gee, I thought the ideas you were getting as you experimented with mice and fruit flies were scary.

Siegfried: Don't be silly! Isaac Asimov's three laws of robots will be programmed into them. But now, we have moved on to a completely different topic, so it's best we leave this titillating conversation now.

Roy: Right you are. Meanwhile, I'll apply my limited biologically developed intelligence to math homework.