On Artificial Intelligence

By Thomas R. Cuba, Ph.D.

Let's be frank. I am not an expert in artificial intelligence (AI). I am, however, convinced that I could qualify as an expert in trying to deal with the current applications of the theory. The most common application that the most common of us run across is that irritating little woman who answers the phone and asks us to press buttons or say words; words that she clearly cannot understand. Oh. As an aside, never, ever try and use the voice recognition interface unless you are in a soundproof closet. Apparently background noise confuses that little lady as much as it does my half deaf aunt Edna.

Now let's be serious. While I am not an expert in AI, as a biologist, I do have a fair understanding of Biological Intelligence (BI). So, to level my internal neuron-based playing field, I did a little research on the AI crowd. One reference I came across was something called a 'technological singularity' another is a man named Ray Kurzweil. The former is somewhat incomprehensible (as it is intended to be) and the latter is a member of a group of people known loosely, if collectively, as futurists. Other members of this group like Freeman Dyson or Carl Sagan may be more familiar than Kurzweil. For reference, Jules Verne was a futurist who may be even more widely known. The difference is that Mr. Verne expressed his views of the future in science fiction books while the current crowd sets their views out as scientific predictions.

As I conducted my research, I recalled teaching a class in computer programming in which I was attempting to explain how a program works. The analogy I used to lay the foundation was in the habits of the classmates. In the morning we wake up, sit up, turn on the light, use the restroom, brush our teeth, shower, comb our hair, and eat breakfast. Each of these is a subroutine in our morning program. Sometimes they are taken out of order but we keep tabs and get them all done eventually. Sometimes being out of order messes up the program.

At the basic level, human actions and computer based actions have some similarities. I am thirsty. I get water. I am no longer thirsty. I will monitor my hydration periodically. If thirsty, go to step one. If not thirsty, continue to monitor. In Macro Assembly language, this sequence is the same as a continuously running do-loop operating as a subroutine.

AI theory poses the question of whether or not computer programs can ever achieve the level of computing power within the human brain. The futurist answers the question affirmatively and then goes on to predict either chaos or peace pursuant to their own inference.

In BI, much like in computer programming, there is range of functionality. Just like BASIC is pretty simply and Macro Assembly Language is pretty detailed, the brain of an earthworm or a grasshopper is operating at a different level than that of your standard *Homo sapiens*. The worm is working at the level of the morning routine I described earlier. There are stimuli which are received by sensors and transmitted to the brain. The earthworm brain doesn't really analyze much but responds with programmed actions. For example, if the earth becomes wet, the worm crawls up. If there is dirt in front of the worm, the dirt is eaten. In BI, this is known as instinct.

Progressing up in complexity within BI systems, we see something called cognition begin to arise. Prevalent in mammals and birds, but not so much in reptiles and amphibians, cognition adds the intangible concept of awareness. Of these, the largest is self-awareness. But I digress.

We need to ask what makes cognition work. We need to know this because without cognition, we can never have imagination, creativity, and emotion. Now I suppose that Mr. Spock would argue that emotion is not bound to intelligence, but it is bound to the brain, and as such must be incorporated into AI if AI is to equal or surpass BI. This link is specifically important when we acknowledge the fact that some BI systems are driven by emotional input.

The main difference between BI and AI, at least so far, is that the human cognitive processes are non-linear. While AI systems can learn, they can only (so far) learn from experience or from predictive models built into the AI system as subroutines. The processes remains linear even if incredibly interwoven or looping. Cognition, imagination, and emotion, tend to be lateral. Thoughts are transferred from one subroutine to another in a manner not yet mimicked in AI. The reason AI may never make this leap is that the information in one BI train of thought (subroutine) is not just transmitted to the second one. Transmittal can be done in AI systems. The information must be recognized as useful in order to achieve lateral thinking processes. That recognition is common in BI systems and absent in AI systems.

Okay - we got way too technical. Let's back it up. Here's the bottom line. AI systems are never going to be able to designate something like a sunset as "pretty" unless pretty is defined in bits and bytes. For BI, "pretty" is based in emotion. Further, pretty to some is not pretty to others. Visit any art museum and derive your own proof of this theorem. AI may not be able to grasp the concept of "that is pretty too" because, in AI, pretty is pretty and not pretty is not pretty. AI proponents will say that they can create a matrix to deal with multiple levels of pretty and solve this problem, but a matrix like that can never warm a heart.

Making a big circle back to that horrible little woman who lives in the phone system, I suggest that in BI systems, the only time you will ever hear "I'm sorry. That is an invalid selection." It will be from your mother.

Footnotes:

1. Computers do have the capacity for mass data storage which already exceeds most humans. Data storage falls far short of cognition.

2. Technological singularity is a term with a non-specific definition but which seems to revolve around the point in time when AI either exceeds or is completely inegrated with BI (like a Borg). Of course, the latter is not AI, but enhanced BI. See footnote no. 1.