Intelligence: Artful or Artificial?

Start looking into the relationship between computers and learning, as I did for an article in this issue, and you're quickly drawn into a vortex of controversy in a flood of opinion. Everyone has something to say about computers and human intelligence—learning theorists, computer designers, ergonometricians, curriculum developers, psychologists, sociologists, molecular biologists, teachers, taxi drivers, and, of course, trainers. Even the neurologist I am consulting about a pinched nerve in my wrist tried to offer me his pet theory.

The article relates what some experts believe we have learned so far about learning with computers. An unsettling subtext of most investigations into computers and learning is the larger question of just how human a computer can be. And even more alarming to consider: just how machine-like is human intelligence?

M.I.T. professor Marvin Minsky, in *The Society of Mind*, writes, "People ask if machines can have souls. And I ask back whether souls can learn. It does not seem a fair exchange—if souls can live for endless time and yet not use that time to learn—to trade all change for changelessness."

It is the ability to change, to grow, and to learn that still distinguishes man from machine. Learning is said to be an intentional phenomena and machines aren't yet capable of intending their own intellectual growth. They need to be given an internal program or concept of a desired objective. Then they can measure the difference between perceived reality and that objective and close the gap.

One of the hottest questions in the debate about whether or not machines can think is whether or not they can feel and be aware. M. Mitchell Waldrop, *Science* magazine reporter and author of *Man-Made Minds*, says the heat of the debate comes from the fact that the people arguing these questions aren't arguing science. "They're arguing philosophical ideology—personal beliefs about what the theory of mind will be like when we find it."

At one pole are those who argue that a perfect simulation of thinking *is* thinking. Tufts University philosopher Daniel C. Dennett has dubbed this position "high-church computationalism" and numbered Marvin Minsky among its evangelists.

At the other pole are the "Zen holists" for whom thinking is definitely not computation. The holists argue that a program that uses formal rules to manipulate abstract symbols can never think or be aware because those symbols don't mean anything to the computer.

Waldrop thinks that the great debate between the computationalists and the holists is a standoff. "The holists have never given a truly compelling explanation of why only a brain can secrete intentionality. The computationalists, meanwhile, remain convinced that they are succeeding where philosophers have failed for 3,000 years—that they are producing a scientific theory of intelligence and consciousness."

Between the two poles, and bridging them, is a third model: the mind as a symbol processor. It shows how feeling, purpose, thought, and awareness can be part of the brain but transcend it, just as DNA molecules that make up a cell obey laws of physics and chemistry and are clearly not alive, yet when they come together in an ordered pattern they are life.

"In the same way," muses Waldrop, "perhaps our minds are nothing more than machines. Perhaps we are just processors of neuronal symbols and spirit nothing more than a surge of hormones and neurostransmitters [my neurologist's position]. And perhaps "The Magic Flute" is only a sequence of sound waves."

From another quarter come more questions. Sherry Terkle writes in *The Second Self: Computers and the Human Spirit*, "The debate about artificial intelligence has centered on the question 'Will machines think like people?' For our nascent computer culture another question is more relevant: not whether machines will ever think like people but whether people have always thought like machines. And if the latter is true, is this the most important thing about us? Is this what is most essential about being human?"

It is intriguing to follow the philosophical thread of nervous speculation that connects the most mechanistic theory of human intelligence and the most holistic, and to think what a new model of intelligence could mean to human resourse development. We may have only begun to learn the truth about learning.

Editor