In memory of Marvin Minsky


Picture source: Wikipedia.

Wikipedia writes: Marvin Lee Minsky (August 9, 1927 – January 24, 2016) was an American cognitive scientist in the field of artificial intelligence(AI), and author of several texts on AI and philosophy. As a visionary "father of artificial intelligence" (in a Turing-like fashion) he was often an outspoken advocate for the view that humans would one day create machines whose intelligence would rival our own. He founded the Artificial Intelligence Laboratory - now known as the Computer Science and Artificial Intelligence Laboratory - and cofounded the Media Lab. He was recipient of several awards, including the IJCAI Award for Research Excellence in 1991 and the prestigious ACM A.M. Turing Award, an equivalent of a Nobel Prize for computer science. In the words of Nicholas Negroponte: "Marvin talked in riddles that made perfect sense, were always profound and often so funny that you would find yourself laughing days later. His genius was so self-evident that it defined 'awesome.' The Lab bathed in his reflected light."

Born in New York City (recently hosting IJCAI'16), he attended the Ethical Culture Fieldston School, the Bronx High School of Science, Phillips Academy, and Harvard University. He then went to Princeton University, where he earned his Ph.D in mathematics in 1954 (the year Turing died). At the time of his death, he was professor emeritus at CSAIL and at the MIT Media Lab.

Professor Minsky laid the foundation for the field of artificial intelligence by demonstrating the possibilities of imparting common-sense reasoning to computers. Fascinated by the mysteries of human intelligence and thinking, Professor Minsky saw no difference between the thinking processes of humans and those of machines. He specialized on computational ideas to characterize human psychological processes and produced theories on how to endow machines with intelligence. He modeled human perception and intelligence, and built practical robots. He designed and built some of the first visual scanners and mechanical hands with tactile sensors, and built the first randomly wired neural network learning machine, which he called Snarc.

As said by Alan Kay: "Marvin was one of the very few people in computing whose visions and perspectives liberated the computer from being a glorified adding machine to start to realize its destiny as one of the most powerful amplifiers for human endeavors in history". Also: "He used to say, 'You don't really understand something if you only understand it one way'". In this way, he also influenced the author of this memoriam to introduce the Principle and Paradox of Multiple Knowledge.

Minsky had argued that several activities (if not most) would be vastly safer and simpler with manipulators driven locally by intelligent computers or remotely by human operators. He foresaw microsurgery could be done by surgeons who work at one end of a telepresence system at a comfortably large scale, which has become a regular practice.

Minsky devoted large amount of attention to perceptrons, machine learning algorithms that capture some of the characteristics of neural behavior. Minsky, working with Seymour Papert, showed what perceptrons could and could not do; together they wrote the book Perceptrons, which is considered a foundational work in the analysis of artificial neural networks. However, some of his criticism of NN capabilities caused a research delay in that field.

Minsky and Papert introduced childhood education using Logo, the educational programming language, and developed the first Logo "turtle" robot.

One of Minsky's best-known ideas centers on a Theory of Frames. He wrote, "the ingredients of most theories both in Artificial Intelligence and in Psychology have been on the whole too minute, local, and unstructured to account–either practically or phenomenologically – for the effectiveness of common-sense thought." He tried to address those issues by "pretending to have a unified, coherent theory" based on his proposal to label data-structures in memory as frames and considering how frames must work, individually and in groups. Today, frames are a major part of knowledge representation and reasoning schemes even though they are often named differently.

Minsky and Papert also developed what came to be called The Society of Mind theory, which attempts to explain how intelligence could be a product of the interaction of simpler parts (in recent years Koch and Tonini kind of destroyed the idea that the smaller parts can be unintelligible). In 1986, Minsky published The Society of Mind, a seminal book on the theory written for a general audience. It proposed "that intelligence is not the product of any singular mechanism but comes from the managed interaction of a diverse variety of resourceful agents," as he wrote on his website.

Underlying that hypothesis was his and Professor Papert's belief that there is no real difference between humans and machines. Humans, they maintained, are actually machines of a kind whose brains are made up of

many semiautonomous but unintelligent "agents." (Again pls note that the current mainstream holds that these agents can be rather simple, but still must have basic properties such as e.g. at least local consciousness to possibly result in a conscious integrated agent. But with this modification, the basic idea stands today as it did then.) Different tasks, they said, "require fundamentally different mechanisms." Their theory was at time misunderstood that humans are machines, but more likely Minsky had in mind that one can build intelligent machines as Turing proposed.

As an extension of the multiple theories Minsky published The Emotion Machine in 2006, a book analysing theories of how human minds work and suggesting alternative theories, often replacing simple one-level ideas with more complex multiple ones. He wrote that our resourceful intelligence arises from many ways of thinking (search, analogy, divide and conquer, elevation, reformulation, contradiction, simulation, logical reasoning, and impersonation) that are spread across many levels of mental activity (instinctive reactions, learned reactions, deliberative thinking, reflective thinking, self-reflective thinking, and self-conscious emotions). With all fantastic systems like Soar putting aside, we are still not able to fully implement his ideas.

In the words of Patrick Winston: "Many years ago, when I was a student casting about for what I wanted to do, I wandered into one of Marvin's classes. Magic happened. I was awed and inspired. I left that class saying to myself, 'I want to do what he does.' I have been awed and inspired ever since. Marvin became my teacher, mentor, colleague, and friend. I will miss him at a level beyond description. "

Note: This paper is to some extend assembled from available publications on this issue with emphasis on the multiple-view theories and the Principle of multiple knowledge, and a huge respect to Marvin Minsky from the author.