High-level Artificial Intelligence: An Imminent Possibility with an Enormous Potential for Good

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The species Homo sapiens, which is Latin for the man of wisdom, was the product of millions of years of evolution towards higher intelligence. When contemplating the many advantages that man has over all the other living creatures on earth because of his superior mental capabilities, one wonders if the evolution of intelligence is over. For indeed, the benefits of possessing an intelligence and wisdom greater than man's would be overwhelming. However, the size and capabilities of the human mind have increased very little, if at all, in the past 100,000 years. Perhaps biological evolution has reached its intellectual limit. This, however, does not mean that the evolution of intelligence is over. Many scientists forsee the development of a completely new form of intelligence: artificial or machine intelligence, which will soon equal and eventually surpass human capabilities.

The idea that a mere machine could be as intelligent as a human is an absurd fantasy in the opinion of most individuals, but perhaps this is only a biased opinion with an air of human chauvinisism. Carl Sagan, the well-known Professor of Astronomy at Cornell University, has named and defined the prejudice which he calls "'speciesism'-- the prejudice that there are no beings so fine, so capable, and so reliable as human beings."[1] Maybe this prejudice prevents us from recognizing that computers will soon be intruding into our intellectual territory. Accepting the idea of an intelligent machine also relies greatly on one's definition of intelligence. The distinguished mathematician I.J. Good, who helped to design one of the first digital computers, recently defined intelligence as "the ability to adapt successfully to a large variety of different circumstances-- to survive in a

complex and frequently changing environment, for example."[2] Using this excellent definition, it becomes apparent that a machine could be just as intelligent as any biological being. Although present computers are only marginally intelligent, possessing an intelligence comparable to that of a chicken, they still represent a threat to our intellectual supremacy since this stage, which took nature millions of years to reach, has been achieved in artificial intelligence (AI) in less than fifty years. As a result, many scientists working in the field of AI "view the current difference between human and artificial intelligence as one of degree, not kind, and predict that the gap between humans and machines will be crossed about the year 2000."[3]

The imminence of this date, which is within the lifetime of most people living today, is due to the exceedingly rapid growth in computer technology. The great reduction in size is especially important. Robert Jastrow, the director of the Goddard Institute for Space Studies and frequent author on AI, has described present computer memories as sets of disconnected pigeonholes where information can be stored and retrieved. This is very unlike the human brain with its myriads of connections between cells, and it is these connections that lead to the great intellectual capacity of man. Present computer research, however, is directed towards creating a single one-quarter-inch chip with the capacity for both logic and memory cicuits. This combination of remembering and reasoning will allow a computer to simulate the interconnectedness of the human brain since any one cell can call on other cells for related information, and the computer can immediately have a wealth of knowledge to work with.[4] Such a sys-

tem will easily match the capabilities of the human mind and make present computers seem simpleminded in comparison.

Some excellent examples of the present state of the art of artificial intelligence are the chess programs. Undoubtedly, playing a good game of chess requires at least moderate intelligence, and current programs are rated at the expert level. In fact, a program called CHESS 4.7 recently won a game against international master David Levy, who expects to lose an entire match to a computer within five years.[5] Anything that can accomplish such a task is certainly more than a dumb machine; nevertheless, present computers must rely on exhaustive mathematical analysis in order to reach such a level of expertise. Most chess programmers estimate that a computer will have to be genuinely intelligent if it is to become the world chess champion. Since playing chess is an excellent test of reasoning, planning, and intelligence, creating a winning chess program gives researchers in AI something to work toward. According to I.J. Good, one "... might say that finding out how to program a computer to play a championship game of chess is one of the most important activities in science."[6]

A frequent criticism of computers is that they cannot do anything original or creative; that they can only do what they are programmed to do. This is not entirely true. Most people think of creativity as something magical and uniquely human. Actually, creativity is nothing more than rearranging ideas and past experiences in order to form something new and original which also possesses an aesthetic or practical sense. Not only is such a function with-

in the capabilities of a machine, but computers have already shown great signs of creative ability. A number of programs have been made that can write fairly good poems and musical compositions. One area in which the computer really excels is mathematical creativity. For example, a certain program, when asked to prove a relatively simple geometric thereom, delivered a totally unique and exceptional proof which was totally unexpected.[7] Later computers, with even greater intelligence and a much larger reservoir of ideas to work with, will make human creativity look trite in comparison.

Another "uniquely" human characteristic which a machine could theoretically possess is emotion. Giving an intelligent machine most emotions would be useless or even detrimental; however, certain emotional responses could be beneficial. Some motivational emotions, for example, could increase efficiency. In Time magazine, Robert Jastrow told of a computer programmed to play checkers. The computer was programmed to play harder-- figure out more moves in advance-- when it was losing. This emotional programming was very successful, and the computer went on to defeat a champion player who had not lost a game in eight years.[8] In a similar fashion, computers can be programmed to be aesthetic. In Omni magazine, Mr. Good told of a computer that was programmed to judge the relative beauty of a number of vases. The computer's ranking turned out to be very similar to that given by a class of art students. Such an aesthetic sense would be very valuable for advancing the arts.

Since it is now evident that an intelligent machine could

possess all of the capabilities of a Homo sapiens, the next obvious question is: What good is such a machine when there is already an oversupply of humans? The answer to this question lies in the fact that after we construct a machine with human intelligence, there is nothing preventing us from producing a machine that is more intelligent than man. Irving Good has called this concept the ultraintelligent machine (UIM).[9] The potential benefit of such a machine is incalculable. Probably the most important task of this bright new machine will be designing and developing a computer that is even more intelligent than it. This second generation UIM would then be set to the same task, and the process would continue until the power of intelligence would be overwhelming. The final result will be a machine that is as far above us on an intellectual scale as we are above the amoeba. Man's intelligence has put him above all other creatures on earth, and with the help of his mechanical progeny, he will be able to climb to much greater heights.

One area that will advance rapidly to new heights is science. Mr. Good sees UIMs increasing our knowledge of the universe at a rate which we could never hope to achieve without them.[10] They will be able to form hypotheses, plan and conduct experiments, interpret experimental results, and eventually formulate new theories and natural laws. UIMs, with their virtually unlimited talents, will be able to quickly solve our energy, environmental, and other technological problems. They will also have the capability to invent new technologies that make life as pleasant and safe as possible. Such science fiction paraphernalia as

climate control and teleportation devices will become a reality. The UIM will also open up the door to the final frontier of space, and allow us to conquer the stars. In the words of I.J. Good: "...once you get UIMs, space travel will become child's play."[11]

Ultraintelligent machines will also be of great value to biological and medical science. They will be able to find ways to increase food production in order to make poverty and starvation a thing of the past. By focusing their intellect on diseases and chronic ailments, they will be able to find a cure for these illnesses. The ultimate result of UIMs' study in medical science will be an amazing increase in human life expectancy. In his interview with Omni magazine, Mr. Good expressed the opinion that since biologists believe that dramatic extensions of life could be achieved at least in principle, that certainly UIMs could raise life expectancy to 120 in a few years. However, in subsequent years even more dramatic discoveries could be made, meaning that today's younger people could live to be a thousand or more.[12]

In addition to living longer, people could also live in a more peaceful and benevolent world since UIMs can also be the answer to our many social problems. Most of these solutions would be a direct result of the advancements in science. With unlimited resources to use, there would be no rational reason for conflict, poverty, or oppresion to occur. Only a difference in opinion due to lack of proper communication could cause a war or other conflict. Mr. Good also sees UIMs solving this problem. He states that many times groups or individuals can not reach a

rational decision because they communicate too slowly. This communication block, which all humans possess, will always keep us "psychologically distinct and separate." Computers, on the other hand, can communicate with each other very rapidly, and thereby they could help to unite the human race under peace.[13]

Therefore, high-level artificial intelligence does indeed have an enormous potential for good. Intelligent machines will be able to free man from the binds of ignorance and solve many of his basic problems. I.J. Good has stated that the ultraintelligent machine is "the last invention that man will need to make, so clearly, it's also the most important that man could make."[14] However, what will be man's status after he does invent a machine more intelligent than himself? Will his intelligence become useless, resulting in human extinction? Will he continue to live as a vestigal species in eternal ennui? Or will he continue to live in a mutually beneficial symbiotic relationship with machines? Perhaps these questions should not be answered now. Since man has always respected the most intelligent answer, it is obvious who (or what) should make this decision.

(148) Your ending was amusingly clever. When I read papers on the future of computers, I still can't help tremble because of my having seen The Forbin Project. As long as man maintains the ability to pull the plug, he is still in control but when speculation runs to machine fathering machine, it becomes a bit spooky. However, one theorist (I can't remember who) pointed out that there would be no reason why the machines would become malevolent. Still . . .

Footnotes

[1]Carl Sagan, "In Praise of Robots," Natural History,84,1, January, 1975, p. 8.

[2]Christopher Evans,"Interview: I.J. Good," Omni, 1,4, January, 1979,p. 118.

[3]Robert Jastrow,"Post-Human Intelligence," Natural History, 86,6, June/July, 1977, p. 17.

[4]Ibid., p.18.

[5]Christopher Evans,"Interview: David Levy," Omni, 1,7, April, 1979, p.134.

[6]Evans, "Interview: I.J. Good," p.119.

[7]Ibid., p. 118.

[8]Robert Jastrow,"Toward an Intelligence Beyond Man's," Time, 111,8, February 20, 1978, p. 59.

[9]Evans, "Interview: I.J. Good," p. 119.

[10]Ibid., p. 120.

[11]Ibid., p. 121.

[12]Ibid., p. 120

[13]Ibid., p. 121.

[14]Ibid., p. 121.

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