

Artificial Intelligence... ...A Window to Mankind

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Introduction

Can machines think?

As humans, we have often asked ourselves why we are so special, why God chose to put us here. We comb the skies looking for other signs of intelligent life through the SETI (Search for Extra Terrestrial Intelligence) program, and try to search for the intelligence in whales, apes and chimpanzees. Finding consolation in none of the above, we try to create our own intelligence, to prove to ourselves that we are not truly alone in this universe. Perhaps it is part our search for identity that we feel we must unlock the secrets to life, to discover whether another intelligence other than our own can truly exist.

Science fiction. We read it, we listen to it, and we watch it in our movie theaters. Artificial intelligence is prevalent in most new works of science fiction, from the droid "C3PO" in Star Wars to the cybernetic being "Data" in Star Trek. Can this type of artificial intelligence ever be achieved? What goes into creating such an intricate and intelligent being? It seems almost unfathomable that a mere machine can mimic a human -- after all, we see computers as machines, mere tools that we utilize in our daily routines. It is true that we are a long journey away from a truly smart computer, but even today we make use of artificial intelligence in an ever increasing number of applications. Robotic arms on factory assembly lines can handle more intricate tasks, the computers in our cars respond to the road conditions and style of our driving. The true test of human ability, however, is whether or not we can pass a computer program off as a real live human, to fool a person into believing they are talking not to an

electronic device, but a real human being.

To better understand artificial intelligence, I had to ask myself several questions: what makes a person seem real? When we speak to a person, how can we tell, without looking, that it is really a person we are talking to? How can we simulate this? I contemplated these questions and realized that people go through experiences, from which they draw on their entire life. Perhaps a truly artificial being must evolve and learn. On the other hand, perhaps we can give an artificial being all of the memories and thoughts that it needs. It seems highly implausible that we can reduce human thoughts down to a set of computer algorithms that all can duplicate with ease. The following essay will not only give the reader a better grasp of artificial intelligence, but also will attempt to deal with the plausibility and implications of a truly artificial being.

The Difference between People and Computers

People and computers are vastly different in the way they think about things -- it is fairly obvious the way a computer can perform complex mathematical calculations in the blink of an eye while we sit pondering for years on how to factor ten digit numbers. However computers are not perfect either. People can look at a word problem, decipher it, and figure out the best way to solve it. If one were to enter the exact same information into a computer, the computer would have no idea of what to do. The ideal problem solver would be a computer that can take advantage of both the speed of computation of a classical computer and solve problems with the same ease as a human. This brings us to the topic of logic.

Logic

Part of the initial problem is that computer logic is discrete, there is always a single answer. This allows us to easily plot its decisions on a decision tree. Each node on the tree would represent a discrete set of decisions taken, and a computer can search and understand every single one of these decisions without actually taking them. (Johnson 39) People, on the other hand, usually make less solid decisions. For example, if we asked whether the Rhine River, which is 820 meters in length, was long or not, we could answer either yes or no. However, the answer is based more on opinion -- we don't have a fixed number in our mind that says "If the river is under 1000 meters it is short, if it is over it is long." Depending on who we ask, we may receive a different answer. This logic is called fuzzy logic -- it is one of the primary distinctions in the logic

of humans and computers. (Mcneill and Freiberger 32) Since logic stems from our previous experiences, it only seems natural to talk about evolutionary steps next.

Evolution

It seems almost ironic that we can have the ability to create a computer program which mimics everything a person can do -- especially since it has taken the human races a millennia to evolve into what we are today. Through millions of years of selection, the world has crafted humans. The ability to create a computer program that has every one of our abilities seems almost unfathomable compared to what the human race has had to go through. If we are to create an artificial intelligence driven computer race from scratch, providing only the raw materials but none of the knowledge, the computer race we create may have to undergo the same evolutionary processes in order to become as great as ourselves. (Humphrys) Since it is impossible to measure the amount of evolution that one creature has achieved, we must measure a computer's intelligence by a method which compares the computers knowledge with our own -- this test of electronic intelligence was devised over 50 years ago -- called the Turing Test.

Turing Test

Turing was one of the greatest mathematicians. He was interested in trying to figure out how one could measure the success of a computer program in terms of whether a computer program has intelligence. He came up with the following rules (Hodges):

The new form of the problem can be described in terms of a game which we call the "imitation game." It is played with three people, a man (A), a woman (B), and an

interrogator (C) who may be of either sex. The interrogator stays in a room apart from the other two. The object of the game for the interrogator is to determine which of the other two is the man and which is the woman. He knows them by labels X and Y, and at the end of the game he says either "X is A and Y is B" or "X is B and Y is A." The interrogator is allowed to put questions to A and B.

He believed that the preceding rules would provide for the fact that if a computer's responses were real enough, one could not tell the difference between the computer and the real person. Some argue, however that the turing test is simply a test of how smart a human is, not the actual smartness of a computer program. Never the less, the turing test remains an important key point in the development of certain AI programs -- programs that are written with the explicit thought of trying to trick a human into believing they are conversing with a real person while in actuality the computer program understands none or very little of what a person is saying.

One should note that the turing test has been created, with a \$100 million grand prize. Each year, approximately 6 programs are entered in this contest -- all of which so far have tried to win the annual \$2000 prize by cheating (Hutchens and Alder) However the turing test's requirements are so great, that it is unlikely that the contest will push the current envelope in AI because of the fact that many of the contest requirements for the grand price are in technologies that haven't been developed yet -- such as video and audio input. Because of these requirements in advanced technologies, the most advanced AI advances will probably come out elsewhere.

Computers and People

Human and Computer Interaction

Humans and computers are destined to interact on a more personal level someday in the future. As computers become smarter, they will no doubt require a more personal interaction to achieve greater results. No longer will we use a computer through interface devices such as a mouse and keyboard to enter data, but instead we will ask it to do required tasks for us, and it will do them with ease, in the same fashion that we ourselves would. In fact, it will become feasible that computers will act and emulate humans -- even to the fact that they will assist us in our daily tasks. In short, these computers will end up masquerading as people.

Computers Masquerading as People

If computers are to be like us, there is no doubt that one day computers will take care of our daily tasks transparently, calling people, arranging meetings, interacting with people in a way that is totally undetectable. As long as one doesn't stray too far from the computer's goal, the masquerading as a person is relatively easy. This is demonstrated through the examination of the Eliza program, a rogarian psychiatrist designed to chat with other people. The vast number of people who chat with Eliza believe they are being understood. The original creator of the Eliza program, Joseph Weizenbaum, believes that the sense a person receives that they are conversing is created largely by the person themselves. (Weizenbaum 188) There is no doubt that one day in the future, we may have real androids that traverse the planet, perhaps even becoming our friends.

It is logical that in the future there will be programs that will assist us in our daily lives -- and completing many tasks for us. This brings us to our next topic -- augmented reality and wearable computers.

Wearable Computers

In the future, it may be beneficial to have wearable computers. These computers would augment reality and augment our memory. These augmenting computers would be built with artificial intelligence in order to help us remember. Imagine having a personal assistant who would jot notes of every interaction -- all one would need to do to recall a previous conversation or to look up an address would be to ask the assistant. In fact, if the assistant were intelligent enough, it would provide that information before you even asked for it, anticipating your needs.

The most important developments in wearable computing are perhaps happening at the MIT media lab. There, software applications are already under development for augmented reality and other uses. For example, imagine yourself walking down the street. As you walk down the street, your computer projects an image, floating about 15 feet in front of you. "Today's weather: sunny and warm with winds from the south east at 15 mph. Humidity 10%, Temperature 68°F, Visibility 10 miles." ("MIT: Augmented Reality") About five minutes later, the system notifies you of new e-mail, and prints it out onto the screen. You can read the e-mail while walking down the street. You walk into your office, and someone comes to meet you. You've forgotten their name -- but that's okay. You've met them before. You touch a key, his face is quickly scanned, recognized, and his name, address and other information is neatly

overlaid below his head.

As you can well see, wearable computers can be very useful as supplements to our daily lives. Currently under development is a sign language interpreter -- a computer program that can interpret sign language for non-speakers. This could revolutionize the way deaf people interact with society, and help to make them more accepted. ("Wearable Computer Based American Sign Language Recognizer")

Wearable computers could also be used in the workplace. Their unique way of overlaying text and graphics in front of a user could revolutionize the way people do skilled labor -- the overlay could point out interesting or abnormal sections of a product, something that may have gone unnoticed, or is totally undetectable by a normal person. The whole point of a wearable computer is to increase the productivity and usefulness of a human, however humans are limited in what they can do -- to increase productivity and usefulness further, we will have to go beyond human limits.

Beyond Humans

Neural Networks

Neural networks are a relatively new concept. They stem from the idea that a brain is made up of thousands on neurons all interacting. Each neuron acts independently, but they all work together to form a more intelligence being. The main idea behind a neural network is that each neuron is simulated, and that through creating a neural network, we can create an artificial brain. (Kasabov 251) To date only small scale neural networks have been created, just a few months ago a neural network was put together that could simulate a simple worm's brain. (O' Malley 61–64) The new neural network runs on a small robotic vehicle, that has a single photo–detector, making it sensitive to light. The programming was recreated directly from the original worm's brain, thus not programmed by a human. This robotic vehicle wanders around aimlessly in the lab it was created in, moving according to the programming given to it by the worm.

Neural networks also provide a way of doing parallel distributed computing. Many believe that in examining these types of neural networks, we can gain an alternative to conventional algorithmic techniques used in classical computing. The advantage of neural nets comes mainly in the fact that they simulate a biological body, without all of the negatives associated with it. (Gurney 4)

By this point, you may be wondering about the actual applications for neural networks. Neural networks actually do have applications -- in topics from agriculture to the sciences. Agricultural uses include determining the optimal size of vegetables to determining the ripeness and quality of a fruit. Neural networks can also be used to

forecast weather data -- they can both interpret and calculate data, as well calculate a forecast quickly based on a large amount of data. Since neural networks are modeled after and work like human brains, many believe they can use them in robots -- making robots smarter and more creature like.

Robotics

Perhaps the most famous of all uses for artificial intelligence systems is robotics. From the android Data in Star Trek, to C3PO in Star Wars, people have been engaged in science fiction with countless numbers of computerized robots. In today's world, those types of robots are still fictional. However even today we use robots in countless applications. The automation of many assembly lines now use robots. For example, many auto manufacturers now employ the use of robots in many jobs which require a large amount of strength -- the use of robots reduces the strain on workers and makes the workplace more safe. ("NUMMI Manufacturing").

The most intriguing use of robotics, however, is one that Mitsubishi just recently created. They have demonstrated robotic fish running AI programs, and swim around in the water. In fact, they look so real that only a close examination of the fish will reveal their robotic eyes. The Mitsubishi company hopes to use these fish both in fish farms, where anglers can practice their fishing, and also in museums -- where extinct fish can be seen swimming once again. They have already created the the 88 pound, 1.2 yard creature, and hope to create an entire tank of extinct fish. ("Silicone sea bream lure Japanese anglers") Robotics in general covers a large topic. There is one study of artificial intelligence, however, which is aimed at developing a specialized system, a

system so smart that it can solve its own problems. These are expert systems.

Expert Systems

Expert systems are systems designed to supply data in a non-traditional fashion. An expert system is composed of a database of knowledge which the system draws upon for information, a knowledge base which can take rules that determine how knowledge is interpreted, and an inference engine, which applies the knowledge to whatever situation it is in. (Mason) Generally expert systems are utilized in corporations or other tasks that are very specialized. These expert systems are very good at what they do, and can draw upon previously existing knowledge in order to solve new problems. In fact, the ISS (international space station) is planning on using an expert system to control many functions which are not constantly monitored -- a system which can decide whether a problem is complex enough to notify an administrator, or simple enough to just be automatically fixed. ("NASA: Communication and Tracking Expert Systems Study for the Space Station") Expert systems, no matter how far AI progresses, is perhaps the one thing which will always be used. In fact, one type of expert system is devoted to help users in their normal lives. These are agents.

Agents

Agents are programs that help a user accomplish tasks. Today in operating systems such as Windows, agents are used to accomplish tasks such as running virus detection software and downloading files automatically for you. However, you may already be making use of agents -- without knowing it! One example: you log onto your computer, doing research. You open up your web browser, and go to your favorite

search engine -- say AltaVista or Excite. You type text into the search text box and hit enter, and a list of results are displayed. Have you ever wondered where the results came from? An agent called a web spider searched through the internet, finding these sites. What web spiders do is traverse links -- they travel from site to site, exploring the different sites that sites link to, and adding them to the database. In this way, search engine databases are always expanding, on their own. In the future, these types of agents will do almost any task for you -- who knows, perhaps your next job will be found for you by an agent!

Philosophies and Moral Dilemmas

Three Asmovian Laws of Robotics

- 1) A robot may not injure a human being, or through inaction, allow a human being to come to harm.
- 2) A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
- 3) A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

Isaac Asmov came up with the preceding rules because he felt that if a robot driven by artificial intelligence were created, it would have to act in certain manner and follow certain rules. Since its thought would belong to itself, and its actions would no longer be directly controlled by humans, it would have to have special programming to assure the safety of people in its environment. One must notice that this is all purely speculation, there are many that believe that "computer algorithms alone cannot be enough to simulate a human" and thus the "three Laws of Robotics are irrelevant." (Humphrys) However, it is still true that "we would not like to see an army of superior computers with huge mental capabilities and great calculational abilities try to take over the world." (Hutchens)

To truly understand the Three Laws of Robotics, however, we must delve deeper into the nature of these new types of machines. If they are indeed smarter than us, then perhaps they will feel superior -- and thus try to take over our society, a society which we created. The creation of an artificially intelligent creature could be the cause of our own undoing -- if we are not careful enough, we may give these creatures more control than we planned -- and thus create unsolvable problems for mankind. Because these new machines will be so much more intelligent than their human

counterparts, it will be almost impossible to out smart them. They will predict our every move, plotting out every combination that could occur -- something that we do not have the luxury of doing. For this reason, it is important to restrain artificially intelligent robots with special programming to deal with the case that we may lose control of these machines.

Is there room for AI?

Before we actually implement AI in a real life application, we have to ask ourselves if there is room for AI. Do we really want machines doing all of our jobs? If machines really do all of the jobs that people used to do, what will people do? Do we really have a need for robots? (Humphrys) Darwin believed that there were certain niches, and that all species competed for placement in these niches -- if one species could fill a niche better and easier than another species, the other species would dominate, and eventually one species would die out. If we were to create real thinking robots, would they not exist in the same niche as us? Would they compete for the same resources? Perhaps the creation of artificially intelligent robots would be our undoing. Perhaps there isn't actually room for an artificial creature.

If robots were to become intelligent and form their own society, their values would be much different than ours. If one examines our society, they will notice that we deal with four different causes of death: war, disease, famine and pestilence. A machine, on the other hand, could theoretically live forever -- their bodies always being updated to the latest discovered technologies. They would not place the same value on life as us, as they can be simply reconstructed. If robots are allowed to roam freely, they could end

up as our rulers.

Free will?

Can we allow computers to have free will? If they do have free will, what kinds of things will they do? They may not follow the same rules that we do, and they could wreak havoc among the population. In fact, what if we gave them free will, and, thinking themselves superior to us, try and take us over? That would make to an interesting turn of events. However AI driven robots might be restricted in the fact that they don't have free will -- they might accomplish less because of the fact that they would be so restricted. There are many negatives and positives, and we would have to deal with them all before we could come to a decision. (Humphrys)

When we examine free will, we naturally look back at the Three Laws of Robotics. By implementing Asmov's ideas, we would be denying robots their rights -- a set of rights that we cherish so dearly. Is it proper to deny robots these same rights? Even criminals are guaranteed specific rights in the United States, yet we would be unwilling to grant these rights to robots -- robots whose logic should prevent them from doing any harm? Is there some flaw in the way humans see "human" rights? There is no doubt that when the technologies come to the point that we can create an artificial creature, there will be great speculation and debate on this subject -- enough argument to prevent the actual creation of such a creature.

Theological outcomes of a new species of smart computers

Here is a joke I found very explanatory on the theological side of AI. The joke goes like this:

A group of computer scientists build the world's most powerful computer. Let us call it "HyperThought." HyperThought is massively parallel, it contains neural networks, it has teraflop (in the time it takes you to blink, the computer will complete 40 billion calculations, a blink takes 1/50 of a second ("How fast will Intel's new Teraflop supercomputer be?")) speed., etc. The computer scientists give HyperThought a shakedown run. It easily computes Pi to 10000 places, and factors a 100 digit number. The scientists try find a difficult question that may stump it. Finally, one scientist exclaims: "I know!" "HyperThought," she asks "is there a God?" "There is now," replies the computer. (Loebner)

At first, you may be lead to believe that the new computer is pronouncing itself as a God. But in actuality, the computer is saying that there is now truly a God -- and that that God is the human race. Because to the computer, humans are its creators, and are thus its Gods. Perhaps if the AI driven computers outlives humans, they will remember us and think of us as we think of those in our theological texts. In creating a new being, we have become the creators, and it seems almost ironic that we ourselves become Gods. There is also the chance that we have nothing to worry about, that they will accept the same values as us, after all, "Everyone wishes to become as close as possible to their creator." (Mitchell).

Being a god is a great responsibility, and it could be that the human race isn't ready yet to take the role of a true creator — for there is no doubt that these new creations of ours will be ridiculed by many. Also, would we, as the creators, be willing to accept the fact that perhaps our creations might start to worship some other deity? What if these robots rejected our religion and started to pray to electronic devices? We would definitely reject their beliefs without a second thought.

Conclusion

The future uses of AI

For AI to become a reality, we have to first recognize its uses. What, exactly, can we use an AI driven computer for? Quite simply, we could, if we wanted, make them into our slaves and never have to do any work again. They could take the place of humans in hazardous jobs, making the world a safer place. But is it really morally correct to make an intelligence race our slaves? Perhaps using slaves could free ourselves to do more important things? These are just a few of the questions we have to consider for future uses.

In the future artificial intelligence will appear everywhere, from the menial tasks of recording a tv program on your VCR to piloting the latest airplane. It is safe to say that there will be many implementations of AI that do not require creating a robot to use. These artificial intelligence devices will greatly simplify every day life, and since these devices operate on a simple level, we will not have to deal with the life vs. AI debate.

Human society and acceptance of AI driven computers

We have to ask ourselves if human society would accept AI driven computers. After all, they would probably compete with us in our daily lives, and could get in our way. Humans also hate change, and there would be those opposed to the introduction of these new machines. Chances are they would do little harm, but could our own human prejudices prevent these species from thriving? The introduction of AI driven computers would be like finding new intelligent life -- they would be radically different

from us, think in a very different way, yet be conscious. Needless to say, it would be very strange.

Chances are that if we created an artificial creature, the creature, no matter how smart or intelligent, would be thought of subordinate to a normal human. They would never be accepted as equal, as "people are very closed minded" (Humphrys), thus they would always be charged with doing the "dirty work" so to speak. They would be treated simply as a valuable piece of hardware, something that could be replaced. One could even consider it cruel to bring an innocent new creature to life in a world that is ruled by discrimination and hatred of those who are different. This also leads us to the question -- will artificially intelligent creatures become our slaves or masters?

AI computers -- slaves or masters?

If we gave life to an artificial creature, we would most likely want them as our slaves -- not as our masters. But would they want to remain our slaves? There is no doubt that these artificial creates would be more or less superior to us: they could compute math at amazing speeds as well as have increased neural activity. Perhaps, if they thought they were superior enough, they might try and take us over -- them become the masters, which they justify because they believe themselves superior to us. We would have to deal with these facts before creating an artificial being.

However, if we treated artificial creatures as slaves, that would violate our current beliefs about "human rights", the very term describes a "homo-sapiens only club". ("Star Trek VI") It also seems that there is no way that a computer can every be on par

with a human, since humans are in the majority. It remains to be seen how this problem will resolve. There is a case, however, where humans will be both the master and the slave -- the case in which a human -- or at least their mind -- can live indefinitely through a computer.

Can humans eventually live forever through computers?

One interesting concept is that we will eventually be able to live forever. What if, at death, our minds are transplanted or duplicated in a robotic being. Thus the robot would continue our existence -- or would it? Would the being inside the robot still be us? Or is there another element of life that we simply cannot duplicate -- thus securing the fact that one cannot create an artificial being? The problem of overcrowding would become worse, however people could start to live in many places they could not before because of this remarkable transformation of man to machine. The souls of all the dead could exist once again, their intelligence existing in every application we use, their consciousness penetrating everything. This would be an example of real life turned artificial. Either way, if true artificial life is created, it will have a great impact on society. It will be a milestone in human achievement, and be the first time that another intelligent life form has ever truly been contacted by the people of earth.

Last reflections on AI and what it means to society

To be able to create an artificial being is to secure that fact that we are not unique in this universe -- that it is indeed easy to create a life form, and that we have the ability to create these easily. If these new artificial beings were created and allowed to roam

around freely like normal people, they would most likely be distrusted and even discriminated against. There is no doubt that many would be afraid of what these new devices are, and the impacts and changes they could have as related to society. If at any time we do decide to create an artificial being, it would mean people would have to generate a new tolerance to these beings -- something which has just barely begun to occur in places like the United States.

The creation of an artificial being would have radical effects on every part of society. From close examination, we can see two possible outcomes. The first outcome is that the world becomes united like never before. The mere existence of a life form other than our own could unite the people of the world in a common goal, and universal peace would be achieved -- because disputes fought by machines means nothing, and if a war would be fought, it would be fought by machines and not lives. Since machines are so easily replaced, war would be virtually eliminated. The other possibility is that an artificial being would divide the world up. The scientists and great visionaries would worship the new creation as the future of mankind (though oddly enough, it isn't even a man). Religious leaders would criticize the new creation as being anti-religious -- that we can become a creator as important as the god we worship ourselves is a rebellious thought. The best way to introduce an artificially intelligent creation is to perhaps introduce it as a normal member of society, and only in the end reveal its true nature. For as long as people believe in it's humanity, that belief is as good as truth. Perhaps the hardest part about artificial intelligence will not, in fact, be in creating the intelligent creature, but to convince society to accept it as a normal member of the human race. For it is in acceptance that we gain true success.

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