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2/27/08
Essay III-final

Make Way for the Robots

With the seemingly limitless growth and advances in robotic technology has come concern over the unpredictable direction of such progress. This anxiety has manifested itself mainly through artistic mediums, including some recently made films and essays—primarily *The Matrix* and "Marriage a la Mode". Both these works illustrate the dangers of advanced robotics, especially in terms of the growing human-robot interaction, by emphasizing the loss of human connection and freedom that could potentially stem from such technology. In *The Matrix*, as a result of superior artificial intelligence, robots asserted their dominance and humans became slaves to the system by living in a virtual world and becoming energy sources for the robots. A different twist on the future of human-robot interactions is presented in "Marriage a la Mode," where a husband and wife are both completely dependent on robots and computers and have never even seen each other. In fact, the husband in the story has not been outside for years.

While these are only futuristic visions and will most likely never happen, there is without a doubt some truth behind these speculations, and a cautionary message to be heard. The technology is already well on its way to creating robots that successfully interact with humans, and artificial intelligence is gaining momentum and interest as the 21st century progresses. Robots are being assembled that will one day perform domestic household tasks, replace human laborers, assist in therapy and hospitals, and tend to the elderly. Increased research and progress concerning adaptive robotic learning and human-robot communication is clearing the path to a society in which one may not be able to tell the difference between a robot and human anymore. This craze over and almost blind

drive towards progress, the desire to find ways for humans to avoid doing things, and the perhaps unconscious aspiration to play God and control everything around us may lead to a deprived world in some respects. Such a world would be not only a world deprived of human labor, but also, and more importantly, a world deprived of individuality, comfort, and human connection—the essence of humanity.

The ability to adapt to one's environment and learn from experience is one held by living creatures. Yet research is being done worldwide, including at MIT, to incorporate adaptation in robots. According to an article from the website *Robotics Trends*, in late 2006, a small four-legged device demonstrated its ability to adapt to its environment. The little robot essentially teaches itself to walk, and then when it is damaged, it adapts and teaches itself to continue moving by limping. Rather than giving the robot a specific set of codes to follow, "the researchers let it discover its own nature and work out how to control itself, a process that seems to resemble the way human and animal babies discover and manipulate their bodies." The robot is built as a "self-model" in that it is aware of its own structure and has "many, simultaneous, competing, different, candidate models" that allow it to change and adapt. The researchers believe that the same algorithm and processes used to construct this robot could be translated into much larger, more complex machines.

This research may seem like a forward step at first, but if one looks at the implications of adaptation in robots, one may realize the possibilities. If robots become more and more adaptive and evolutionary, then the extent of their abilities may reach out of our control and the line of distinction between humans and robots could become even dimmer.

Not only are robots being created to adapt to their physical environments, but they are also being manufactured to respond and learn from human interaction. In a recent study at MIT, postdoctoral associate Aaron Edsinger has been working on a robot named "Domo" for three years and describes the robot as the '"next generation" of earlier robots in that it is "designed to interact with humans" *and* "manipulate unknown objects." According to the article on the MIT news webpage, Domo's visual system is attuned to unexpected motion and can locate human faces and objects in human environments. Domo has the ability to sense when a human is touching it and respond, and Edsinger believes that such robots would be "useful in the home," but "it's important for them to have a humanoid form, so people will feel more comfortable around them." However, it is my opinion that no comfort will exist between a human and robot as it does between humans because the human will always be aware that its partner is an artificial machine. And even if the robot looked exactly like a human, the knowledge that it is in fact a bunch of wires and was made in a factory would make the interaction even scarier. While robots that perform all household chores are still a dream (for some people), it is becoming a reality in the labs of MIT where robots are opening water bottles and talking to eager researchers.

An example of an up-and-coming system that brings together all of the above components, including adaptability, communication, and assistance, is Intelligent Space (iSpace). According to an article in the acclaimed journal *Artificial Life and Robotics*, researchers are beginning to assemble a platform on which to implement advanced technologies to perform "smart services" for humans. This space can be a room, corridor, hallway, or wall. The space includes color information, networking multi-cameras, a

human-following mobile robot system, a path generator, and a number of other state-of-the-art robotic and sensory technologies. Proposed by the Hashimoto laboratory in the University of Tokyo a few years ago, the concept of intelligent space has the ultimate goal of providing an interactive space that "comprehends human intentions and satisfies them." It uses computer monitors to observe the clients and mobile robots to navigate about the space and provide assistance. The space could be a room, corridor, or street, and is a cooperative system containing a network of computers and robots that has the ability to learn and adapt through these distributed intelligent networked devices (DINDS). Its artificial spatial memory allows for the efficient exchange of information and assistance between humans and the iSpace. Although it is well on its way, more work is being done on this revolutionary technology in order to turn it into an efficient, beneficial, and safe reality in the near future.

But the increase in human-robot interaction and the further "humanizing" of robots fosters concern over the future. Will people be comfortable in a space under the control and surveillance of robots at all times? Will humans that already perform assistive jobs such as doormen, waiters, and caretakers cease to exist? And will such human connection that we take for granted in these small situations be broken by this new technology? I think these are valid questions to consider before digging ourselves deeper and deeper into the hole of irreversible technological advances. The stories of *The Matrix,* "Marriage a la Mode," and countless others suggest that robotic technology could do damage to our society, and I agree that integration can create discomfort and emptiness among humans due to the vanishing of human-human interaction to make way for the robotic technology. Furthermore, as described in vast amounts of science fiction,

these actions may lead to unpredictable consequences because we *thought* they were under our control. There is a basis behind such stories, and it is the failure of humanity to resist progress, or at least adequately consider its effects.

Although the iSpace is still underway and has not yet become a reality, there are robots out there right now that are *very* real in terms of their autonomous behavior and truly scary abilities. In a book titled *Advances in Human-Robot Interaction*, scientists refer to the "dream" of assistive robots that carry out a number of chores, including "playing with the children," and believe it is worth pursuing due to "considerable economic and social potential." They hope that one day robots will "be instructed as effectively and intuitively as a human," and see that the major barrier to this "dream" is the interface between and coexistence of humans and robots. In 1999, a project called MORPHA began in Europe with the central idea of equipping robots with "powerful and versatile mechanisms, which would enable these robots to communicate, interact, and collaborate with human users in a natural and intuitive way"(10). Such mechanisms include natural communication and speech, mimic, gesture, exertion and force sensors, touch, and coordination. The project was completed in 2003.

The troubling thing about such a project is that it seems they simply want to create another human. Scientists and researchers are obsessed with the idea of manufacturing a machine that is like a human in every way, shape, and form. This appears to be paradoxical because of the extreme population growth that is projected for the next decades. Competition for work will become fiercer than it already is for real humans even without the introduction of robots who will undoubtedly replace many laborers. Although roboticists everywhere, including the writers of the book *Advances in*

Human-Robot Interaction, assert that the robots will serve primarily assistant roles and humans and robots will be "partners in joint manufacturing processes"(105), our search for efficiency will inevitably make human workers unnecessary as the machines take over. And where will the humans go then?

According to the book, scientists at the Hanover Industrial Fair in 2002 successfully demonstrated a number of cutting-edge robotic abilities. In a series of tests called "OrderPicking" and "CarrierClear," a manufacturing assistant robot placed objects in different containers and then returned them to their original position. It never failed after multiple runs. In a "robotic bar scenario," a robot named "MobMan" demonstrated "flexible grasp-and-place skills, speech, face detection"(231) and other higher-level behaviors such as opening doors, navigating, and cleaning. And a number of other robots at the fair, including "Care-O-bot" and "Cora"(Cooperative Robot Assistant), demonstrated mobility, vision, force senses, speech, gestures, and recognition. It seems that scientists have essentially just created humans that can be put under their control. But now that control comes without the guilt (or legality) that stems from violation of human rights or free will.

The idea of human-robot interaction is on the forefront of current artificial intelligence research, especially the subtopic of human-robot communication. Roboticists believe that it is vital to build robots with strong natural communication abilities in order to attain acceptable integration. In his thesis titled "Coordinating Human-Robot Communication," MIT graduate student Andrew Brooks declares that it is essential to "build more complex, communicative robots, and more of them"(8). His graduate work consisted of testing four different robots, each designed for different proficiencies, and

improving the communication skill set of such robots. He successfully demonstrated mimicking, self-modeling, inward attention, "multimodal gestural grammar," "behavioral overlay"(189), comprehensive communication repertoire and "personality," timed action sequences, and interactive communications in the robots. In other words, the robots performed natural speech involving body language and facial expressions, were essentially aware of themselves, and could reason and effectively learn without the use of code or pre-arranged script.

In another article in *Artificial Life and Robotics*, researchers Johan Bos and Tetsushi Oka describe a similar study as the one above in which they fine-tune robotic speech: "A successful implementation of a talking robot requires a good understanding of…acoustic signals, the syntactic structure of the language, the meaning associated with it, and the underlying goals derived from it"(44). In their research, they developed a spoken dialogue system and matched it with the interface of a real robot, called the RWI Magellan Pro, in order to create a robot that "react[ed] to contradictory information or obvious information"(44) and answered questions. The robot also used a speaker-independent speech recognition system developed by Nuance, which allowed the robot's speech to sound much more natural and fluid.

The research above shows that there are robots out there today that could easily pass as human if you were blindfolded and having a conversation with them. The extent of technology has come so far that robots are being built that are human-like in so many ways—in movement, form, speech, ability, and senses, to name a few. In fact, such machines are becoming more and more similar to humans each day, and that line that separates humans from robots becomes dimmer and dimmer. If the world of the present is

one with speaking, adapting, monitoring, mobile, autonomous robots, what will the future be like? Will humans and robots integrate without fear or discomfort? Or will the stories of science fiction writers for decades become realities as the world becomes a bleak place void of human passion or care and filled with chaos and monotony? Of course there are situations where advances in robotic technology are truly advantageous. An excellent example is the use of robots for space missions, where human lives are not put at risk in space thanks to robotics. However, it is clear that even today, robots are capable of incredible but scary things. The integration of humans and robots is already occurring and scientists are urging it to continue and to accelerate. But this human-robot interaction comes with a heavy price. As we become more advanced, it is probable that the growing population will struggle even more to find jobs, and the presence of robots in our society will make us less comfortable. But more importantly, the concept of our genuine "humanness" will fade, and the inherent spiritual connection among all humans will be lost as we make way for the robots.

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