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Annual Meeting CLE Recap

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ROBOTS, THE HUMAN BRAIN, AND THE LAW

***13** **A**t the ABA Section of Science & Technology Law's 2007 Annual Meeting, the Life Sciences Division sponsored a discussion of scientific developments and legal issues associated with the use of robots in society, and the impact of robot-like enhancements to the human brain.

The Common Law of Robots

The panel demonstrated that robots are gradually leaving the realm of science fiction and fantasy and becoming a reality that needs to be addressed by all of the social sciences, but most especially by the law.

Sixty years ago, the science fiction writer Isaac Asimov first asserted the common laws of robot behavior:

- First Law: A robot may not injure a human.

- Second Law: A robot must obey orders given to it by a human except where obeying such would conflict with the first law.

- Third Law: A robot must protect its existence as long as such protection does not conflict with the First or Second Law.

Subsequent writers asserted two additional laws: The Fourth Law (robots may not harm humanity or by inaction allow humanity to come to harm) and the Fifth Law (a robot must know it is a robot and identify itself as such).

Since Asimov's time, sensational tales (such as the recent American film, *A.I.*) have speculated about the potential impact of robots on human society, with fictional accounts of robot rebellions, as well as various takes on the exploitation of robots for human gratification, companionship, or service. Despite--or perhaps because of--the attention of popular culture, society has not seriously considered the legal issues raised by robots.

Yet, human interactions with robots are bound to increase. At this very moment, robots with humanoid characteristics are being developed for commercial use in the law enforcement, rescue, warehousing, education, health care, and other knowledge and professional fields. At the same time, increasingly advanced techniques are allowing the use of technology to restore, modify, or enhance human capabilities, including the human brain, creating ever greater potential for legal conflicts regarding what is “normal” human behavior-- conflicts far more difficult to resolve than the use of steroids by athletes or the competition

against “normal” athletes by athletes using prostheses. The legal community is lagging far behind robotic and medical science in seriously considering the ramifications of the use of these new technologies.

The 2007 Life Science Panel

The Life Science Division's presentation at the 2007 Annual Meeting highlighted many of these concerns.

• Discussing the scientific advances in robotic science was Professor Hiroshi Ishiguru, Director of the Department of Adaptive Machine Systems and Professor at the ATP Intelligent Robotics and Communications Laboratories, Osaka University, Japan. Professor Ishiguru described his research and development of humanoid and what he described as “geminoid” robots.

• Discussing the ramifications of the use of technology to enhance the human brain was Professor Hank Greely, professor of law at Stanford Law School, and cochair of California's Stem Cell Commission. Dr. Greeley surveyed medical and technological interventions in human mental and cognitive performance, and the legal issues that have arisen or are likely to arise from these activities.

The State of Scientific Research in Humanoid Robots

Professor Ishiguru was invited to address the ABA audience because his team researches human cognitive interaction with robots and uses that research to adapt the engineering of robots themselves. Professor Ishiguru began his discussion by offering some background in the progress of robotic science. He distinguished “humanoid” robots (those that have the external physical appearance of a generic human being) from “geminoid” robots (robots intentionally designed to look and respond like an identical twin of a particular human). The professor's team has developed geminoid robots having synthetic skin with hairs and electrical receptors, which can respond to touch. They can change facial expressions, move their eyes, and discern patterns of interaction among groups of humans in their vicinity. The human twin of a geminoid robot can “see” and speak through the robot from a remote location via the use of cameras and microphones installed in the robot. His team has made the inventions enabling these advances--synthetic electro-sensing skin, optical receptors that sense the robots' location in relationship to its physical surroundings, and software programs that allow the robot to analyze and predict the behavior of nearby humans.

Prototype adult geminoid robots are already functioning realistically, and his team is working to perfect the basic movements of infant and toddler models, such as turning over, crawling, and standing.

Professor Ishiguru approaches his research with the goal of optimizing human interaction with robots. He explores why humans like robots, and has analyzed the point at which a human's comfort level with a robot decreases. He describes the gradual ***14** decrease in comfort as the “uncanny valley of interaction” between humans and human-like devices. He identifies this “zone” by comparing human reactions to, for example, an inanimate child's doll and a lifelike geminoid that has human-like skin, facial expressions and tics, and shifts its body and makes eye contact in a lifelike manner. He has found that people are comfortable and interact well with the doll because it is so far from a real human.

But humans are also apparently comfortable with a robot that is indistinguishable from a real human. It is the place between--where as a device approaches being a stereotypical mechanical robot--that the resemblance creates unease. Increasing human comfort with robots, and therefore optimizing the interaction, consequently requires that the robot possess visual and physical characteristics, and ways of interaction, that are as indistinguishable from live humans as possible.

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To increase the resemblance of geminoids to live humans, Professor Ishiguru studies how the humans interact, listen to, follow directions from, and work with geminoid robots, especially as the robots are improved. Dr. Ishiguru's team has created networks of sound and sensory receptors in the room where the robot operates, which allow it to interact in a more lifelike manner. For example, a robot can sense how a group of elementary school children interact by assessing their physical position in relation to each other and to the robot. The robot can use this information to predict the children's interests and to then guide them to museum exhibits that match those interests. It can also use this type of information to establish contact with mall visitors and vocalize directions to places of interest, using both a programmed set of directions and a reference to a human representative if more information is needed.

The team continues to work to improve the robots' human-like characteristics. The current state of adaptive intelligence limits the robots' independent conversational ability, which seems to be the largest hurdle to true human-like interaction. But when a geminoid robot is used by a human who can see and hear what the robot sees and hears and can provide suitable verbal responses for the geminoid from a remote microphone, then the geminoid's mimicry of human behavior is nearly perfect. Professor Ishiguru showed film clips of a television news reporter whose twin geminoid delivered the news; a side-by-side comparison showed differentiation between the human and robot to be most difficult. Similarly, the professor's geminoid has been used to deliver lectures remotely while the professor speaks and answers questions through it.

Professor Ishiguru reported that in Japan's rapidly aging population and declining workforce, the use of humanoid robots is being field-tested for replacements of human guides, security guards, service, and even knowledge-based workers.

Legal Implications of Robotic Research

Japan's national society of engineers is considered the main advisory group to the government concerning both scientific and potential legal issues arising from the use of robots. However, to date the only legal concern regarding interaction between robot and humans that has been raised in Japan is that of the physical safety of humans in these interactions.

The panel pointed out that an imaginative legal mind can identify many legal issues likely to arise as the technology progresses. If a robot is designed, for instance, to be sentient and to make judgments, and the robot is injured or intentionally injures others, what are the various rights and liabilities of manufacturers, programmers, owners and the robot itself? A serious proposal to consider extending basic legal rights to sentient robots was published in a recent British government report.

Additional issues may include: What are the intellectual property rights and protections when a robot begins to discover or invent independently?

***15** What are the employment law implications of robots working side-by-side with humans performing the same tasks and even supervising humans? How will robots be valued as assets for financial and tax purposes? Moving out of the business world, what are the family law implications if an owner wishes to leave an estate to a robot or develop contractual or familial relationships with a robot? Ethically, should there be codes limiting those who wish to develop robots?

Enhancing Human Mental Performance through Medicine and Technology

Professor Greely delivered the panel's second presentation. For those who follow the popular and legal developments in the world of “artificial” enhancement of physical performance through technology and drugs, Professor Greely's remarks about the potential of brain enhancement raise the specter of a period of debate that will be “deja vu all over again.”

While Professor Ishiguru described robots as becoming more human, Professor Greely described methods of treatment, diagnosis, and imaging of mental and neurological disease, as well as treatment of disabilities and enhancement of performance where the use of science raises potential legal concerns. His example underscored the potential for humans to acquire more

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robot-like brainpower and sensory precision from artificial intelligence as well as cognitive and physical enhancements from drugs and electromechanical devices.

In his view, there are three existing streams of technology affecting the brain. These are the use of technology to predict a person's future pattern of behavior, including antisocial behavior; the use of technology to determine truth-telling for legal proceedings; and the use of clinical and pharmaceutical interventions to cure, repair, or enhance impaired brains, and the extension of these interventions to boost mental performance in normal brains. He cited as an example the use of MRIs are already being used to identify brain plaque buildup (believed to be a precursor to dementia), or to assess and categorize the brain chemistry of young antisocial persons or adult deviants.

Professor Greely also reported that rapid advances are being made in the technology to repair, treat, and enhance mental, neurological, and behavioral functions and abilities. For instance, in the near future, neural connections may be rewired, to restore motion to paralyzed persons or to reverse dementia. Cravings for heroin could potentially be removed surgically.

He also described the potential to boost mental performance in normal brains. He reported experiments in which a person appeared to train himself to have paranormal powers of perceiving the approach of aerial objects while blindfolded.

Legal Issues Associated with Technological Enhancement of the Brain

Professor Greely highlighted a number of legal issues that may arise from technological enhancement and assessments of the brain. For instance, to what extent should this information be admissible as scientific evidence, or shared with the individual himself, with law enforcement employers, with insurers or others? To what extent will identification of certain brain chemistry patterns affect the “free will” concepts of criminal law? Experiments are ongoing to detect through brain scans whether a person actually perceives pain. Should this be admissible evidence in liability actions?

The audience for the sessions were left to ponder the scope and complexity of the local puzzles that these futuristic science and technology developments present. The future suddenly seemed a lot closer.

The Science & Technology Law Section's New Artificial Intelligence and Robotics Committee

The timing of the August panel coincided with the Section's announcement of the creation of a new committee: The Artificial Intelligence and Robotics Committee will explore the crosscutting legal and physical and life science issues emerging in the area.

The Committee will address all aspects of law and devices that replicate or appear to replicate human mental or physical activity, learning, reasoning, communicating, manipulating objects, and so forth. The Committee's work will be divided into two broad topic categories. The first area will address advances such as automated contract drafting and interpretation, compliance monitoring, and even law enforcement. The second will track changes in statutes, regulations, and case law about or that specifically affect parties engaged in artificial intelligence and robotics work.

As the technology advances, the Committee will address the challenges posed by ever smarter and more dexterous machines that can outperform humans. The Committee goal is to assist those advising technology companies, incorporating new technologies into their practice, lawyers in technology roles, and those who just want to be at the head of the curve. The Committee will soon offer a list serve, online publications, and working groups. Webinars and teleconferences will follow. All Section members are invited to sign up now through the Section's website. K. Krasnow and Matthew Henshon are leading this new effort, supported by Stephen Wu.

Footnotes

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