

## FACULTY COLUMN

## Robot Ethics

*From the battlefield to the bedroom, robots of the future raise ethical concerns.*

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**RIGHT:** Robotist Ronald Arkin, a Regents Professor in the Georgia Tech College of Computing, is exploring the ethical implications of personal robots.

As robots edge ever closer to having fundamental impact in our daily lives, more and more concerns are being raised on just what this will really mean.

For example, Bill Joy, co-founder of Sun Microsystems, argues that robotics is sufficiently dangerous to call for complete cessation of all research on the subject. Others, such as Carnegie Mellon University robotics researcher Hans Moravec, forecast, somewhat gleefully, the day when robots will replace humanity and will serve as our natural successors. Indeed in his vision we, as humans, may become them.

Recently, I have engaged in considerable introspection, largely due to my long-term involvement in robotics research. As a scientist I have explored many different domains, all of which impinge on ethical concerns, and I will share a few here.

Robots in warfare are becoming the standard for the United States military of the future. A congressional mandate requires that by 2010, one-third of all operational deep-strike aircraft be unmanned and by 2015, one-third of all ground combat vehicles be unmanned.

While reducing the number of our soldiers on the battlefield seems at first an easy decision, there are many questions related to the viability of this approach. One concern is the issue of lethality, i.e., will intelligent robots be allowed to make decisions regarding the application of lethal force against humans in war without requiring direct



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human intervention (can a robot pull the trigger on its own)? Can robotic soldiers ultimately be more humane (humane-oids?) than actual warfighters by incorporating a means for ensuring that the laws of war are strictly followed? Our laboratory is currently exploring these questions for the Army, while concurrently designing complex, multi-robot mission software for the Navy.

On the entertainment front, I have been involved with the development of entertainment robots for almost a decade with Sony Corporation's AIBO (dog) and QRIO (humanoid) robots. The seemingly benign goal here is to create robots that bring joy and happiness into people's lives, especially among the elderly, and that can serve as life-long partners, not unlike pets or companions.

The real question from an ethical perspective involves the incorporation of human psychological models to tap



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## CATCHING THE CULPRITS

**When food products are recalled because of safety concerns, the recall is massive because the company doesn't know when the product in question came through the plant and the potential for cross contamination. The Georgia Tech Research Institute (GTRI), is developing fully automated robotic systems that eventually could — with future improvements in sensors, such as GTRI's biosensor — detect contamination in real time.**

deeply into an emotional vein unbeknownst to the observer. This in many ways is in common with advertising, cinema, video gaming and other forms of entertainment. The physical embodiment of these robots, however, adds a special dimension that has caused concern among some ethicists and philosophers, particularly in terms of our society abrogating its responsibility for maintaining and enriching human-human contact with the aging. The use of such robots, according to this view, essentially provides an artifact displaying an illusion of life, thus encouraging a further loss of contact with reality by the elderly.

Related to this is the notion of human-robot intimacy and sexuality. The VCR and the Internet have been propelled by pornography to the ubiquity they possess today. It will not be a surprise to see the robotics field also move rapidly in this direction, which it already has in limited ways. We as a society might do well to consider where this might lead: the impact of sex industries built up around this new technology (not simply advanced sexual toys); the consequences of robotic sex therapy perhaps targeted for the rehabilitation or management of sex offenders; robot prostitution; and ultimately, the choices regarding human-robot intimacy on a more permanent basis. As I've said in the past, would you want your daughter to marry a robot?

A more traditional ethical question for robotics is its impact on unemployment. What would happen if instead of concentrating on the traditional robotic tasks of the "3 Ds" (dull, dirty and dangerous), we moved into more mundane environments, such as babysitting, housecleaning and other service industries? What are our responsibilities to displaced workers as a society? Are there lessons from the previous revolutions (industrial and computer) that we can apply here? In the extreme, what if the cost of labor drops to near zero? Will we have a utopian environment of leisure and wealth for all people? Or instead a dystopian future, including humanity's

return to a slavery mindset (albeit robotic), governmental instabilities due to the outsourcing of all work for our species, and a complete dependency on robotic technology where people can no longer function without these machines at all?

If you find some of these issues unsettling, you are not alone. Hence there is now a strong push within the roboethics community, which originated from a series of workshops involving scientists from the robotics community, as well as representatives from the Vatican, the Pugwash Institute and the Geneva Convention, among others, to engage in this debate.

Some evidence of progress is the release of the recent EURON Roboethics Roadmap ([www.roboethics.org/](http://www.roboethics.org/)). At the IEEE Conference on Robotics and Automation ([www.roboethics.org/icra07](http://www.roboethics.org/icra07)), members of the roboethics community will attempt to further engage society in what many of us see as the need to manage critical choices in our field proactively as we move closer and closer to the upcoming robot revolution. **rh**

**Additional Reading**

- "Why the Future Doesn't Need Us" by William Joy, *Wired*, Issue 8.04, April 2000
- *Mind Children: The Future of Robot and Human Intelligence* by Hans Moravec, Harvard University Press, 1990
- "The March of the Robot Dogs" by Robert Sparrow, *Ethics and Information Technology*, Vol. 4, No. 4, 2002, pp. 305-318
- *Love and Sex with Robots: The Evolution of Human-Robot Relationships* by David Levy, Harper Collins, 2007
- "The Birth of Roboethics" by Gianmarco Veruggio, Proc. ICRA 2005 *Workshop on Roboethics*, Barcelona, Spain, 2005

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Georgia Tech and Bryn Mawr are able to give students their own robots by using an existing commercial robot called Scribbler™ which is sold to universities at a discount rate. To read more about the new Institute for Personal Robots in Education, based at Georgia Tech, see the article at: [gtresearchnews.gatech.edu/reshor/rh-w07/ipre.html](http://gtresearchnews.gatech.edu/reshor/rh-w07/ipre.html)

**INTRO TO THE FUTURE**

**College students hoping to pass a required introductory computer science course now have a chance for learning fundamental, often-abstract concepts in a hands-on way. They are learning programming by making small, two-wheeled personal robots move and interact with each other.**



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