



S. NELSON/WFPN/PHOTOSHOT

Military surveillance drones must be designed in accordance with laws governing warfare, such as the avoidance of civilian casualties.

## ROBOTICS

# Morals and machines

A view of robotics reveals ethics has not kept up with technology, finds **Braden Allenby**.

**F**antastically complex technological systems now criss-cross Earth, harnessing nanotechnology, biotechnology, information technology, applied cognitive science and, of course, robotics. How do we regulate such systems? Adaptively, according to a book that considers the evolving and unpredictable nature of the robotics frontier.

*Robot Ethics*, edited by philosophers Patrick Lin and Keith Abney, and computer scientist George Bekey, is a timely round-up of sensible ethical and policy responses to advances in robot technology. The book provides an accessible introduction to a topic that becomes contentious when one considers the risks to humans, such as the potential failure of robotic cars. The development of cyborgs is another example — for some, these machines with both biological and artificial parts are as much cause for unease as for elation.

The book's contributors address a

wide spectrum of concerns: from robotics expert Noel Sharkey on military applications and philosopher Peter Asaro on the legal perspectives, to ethicists Jason Borenstein and Yvette Pearson on robotic carers in ageing societies. Robotics aimed at childcare, medicine, surgery and even recreation also get a look-in.

Several chapters touch on Isaac Asimov's 'Three Laws of Robotics', which first appeared in his 1942 science-fiction story *Runaround*, and still spark debate. The laws state that robots must not hurt humans,

must obey humans and must protect themselves, and illustrate the underappreciated importance of

science fiction as a visioning device for emerging technologies. The laws also serve to show how far we have come in thinking about the

**Asimo is designed to aid people who lack mobility.**



## Robot Ethics: The Ethical and Social Implications of Robotics

EDITED BY PATRICK LIN, KEITH ABNEY AND GEORGE A. BEKEY  
MIT Press: 2011.  
400 pp. \$45, £31.95

ethics of robotics — a good thing, given that Asimov's stories mainly highlighted the laws' inadequacy.

Roboticians are now integrating technology with humans in ways that challenge fundamental ethical and cultural ideas. As prosthetics become more powerful and computer-brain interfaces move ever closer to cyborg territory, the definition of what it means to be human

becomes unpredictable in new ways. Yet as this book makes clear, ethics has not kept pace with complex techno-human systems, such as 'augmented cognition' networks that boost a person's capacity to handle multiple streams of incoming data. For example, who is responsible if an autonomous military robot kills a group of civilians?

T. YAMANAKA/AFP/GETTY



The manufacturer, the commander, the operator or the robot itself? The time for ethical considerations is now — once the technologies are embedded, they will be much harder to change.

The book touches on another hotly debated issue in robotics: military applications and their impacts. These include the operational, policy, governance and ethical implications of unmanned aerial vehicles or insect-sized mobile surveillance devices. Greater challenges will arise when such technologies migrate

**“The time for ethical considerations is now — once the technologies are embedded, they will be much harder to change.”**

into civil society; imagine what divorce lawyers, or internal security organizations, could do with tiny mobile surveillance cyborgs.

*Robot Ethics* succeeds as a stand-alone text, with its varied contributors striving for objectivity and avoiding hyperbole. The broad spread of applications discussed is key because the ethics differ depending on the use. Military robots, for instance, must be designed to obey the laws that govern warfare. Carer robots must be capable of interacting with patients, who may give them trust and even affection.

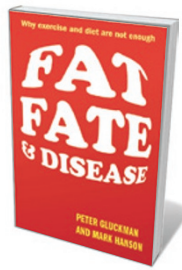
However, there are omissions. The lack of a contribution from robotics expert Ronald Arkin at the Georgia Institute of Technology in Atlanta is glaring, because several chapters cite and challenge his work on autonomous lethal military robots. A chapter summarizing the state of the technological art in robotics would have been valuable, so that a novice reader could distinguish between existing technologies — which raise concerns that might need to be addressed immediately — and hypothetical inventions.

Similarly useful would have been a summary of the underlying economic and cultural factors driving robotic technologies. That would help to distinguish likely scenarios from economically or politically impractical ones. For example, military robots are likely to be implemented because they save soldiers' lives. So outright bans on robots might be politically impractical, suggesting that regulation is more realistic.

By portraying robots as real-world experiments in ethics, *Robot Ethics* conveys an important lesson for our technological era: we must develop responses to emerging technologies in real time, rather than simply reacting to them using existing ethical frameworks. ■

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## Books in brief



### **Fat, Fate and Disease: Why Exercise and Diet Are Not Enough**

Peter Gluckman and Mark Hanson OXFORD UNIVERSITY PRESS 304 pp. £16.99 (2012)

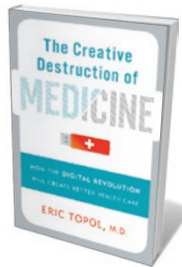
Today's 'epidemics' of heart disease, obesity and diabetes could go global just as the squeeze on planetary resources tightens. Disease-development experts Peter Gluckman and Mark Hanson probe why we are losing the battle. Arguing for the inclusion of cultural, social and biological realities, they explore how fat and disease are linked; lifestyle shifts in the developing world; and genetics and fetal development. The solution, they say, lies in focusing on the health of mothers and children.



### **Design in Nature: How the Constructal Law Governs Evolution in Biology, Physics, Technology, and Social Organization**

Adrian Bejan and J. Peder Zane DOUBLEDAY 288 pp. \$27.95 (2012)

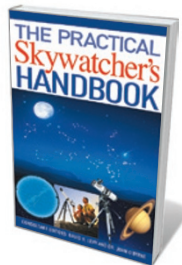
What links the alveoli of the human lung and a bolt of lightning? The answer is branching — a configuration that is optimal for the flow of oxygen, electricity and much more. Mechanical engineer Adrian Bejan and writer J. Peder Zane make a fascinating case for how a single law of physics governs shape and structure in everything, animate or inanimate. By reframing things as flow systems, they reveal how function determines form in everything from corporate hierarchies to Canada geese.



### **The Creative Destruction of Medicine: How the Digital Revolution Will Create Better Health Care**

Eric Topol BASIC BOOKS 304 pp. \$26.99 (2012)

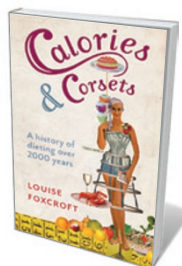
The digital age opens up the possibility of a new type of medicine in which an individual's health data are digitized using wearable sensors, smartphone apps and genome information, writes geneticist and cardiologist Eric Topol. With this wealth of data, medical interventions could be tailored to our uniqueness. Topol covers failures in patient information; what might happen if genomics, imaging, sensors and better health information were to converge; and the potential pitfalls of this brave new medical world.



### **The Practical Skywatcher's Handbook**

Edited by David H. Levy and John O'Byrne A&C BLACK 480 pp. £16.99 (2012)

Astronomer David Levy and physicist John O'Byrne provide zealous amateur stargazers — and serious sailors who need a backup to the Global Positioning System — with a comprehensive 'field guide' to the heavens. Every constellation in the Northern and Southern Hemispheres is mapped across 150 sky charts, with easy methods for finding the brightest stars and working out the rest. Levy (co-discoverer of Comet Shoemaker–Levy) and O'Byrne also give the lowdown on which stars are visible with the naked eye.



### **Calories and Corsets: A History of Dieting Over 2,000 Years**

Louise Foxcroft PROFILE 240 pp. £14.99 (2012)

Medical historian Louise Foxcroft's astutely researched chronicle of dieting is amusing, alarming and poignant by turns. She recounts how Hippocrates advocated vomiting and naked jogging; how the Royal Society experimented with the potato as a hunger suppressant in the seventeenth century; and how 'remedies' from metal corsets to industrial diet drinks have sometimes proved lethal. Foxcroft sees *diaita* — an ancient Greek philosophy centred on all-round health — as more sensible than a fixed focus on fat.