



22 April 2008

Members' Dining Room, House of Commons

# Intelligent Robots in Science and Society

The science-fiction vision of robots smarter than humans that demand their own rights is still just a dream. But worldwide, robots are playing an increasing role in human lives. This parliamentary seminar is an opportunity to meet the scientists and the robots at the cutting edge of UK research and will highlight the ethical questions raised by intelligent robots in science and society.

## **Programme**

### **4.05pm** Chair's Welcome

Lord Sutherland of Houndwood, member of the POST board

### **4.10pm** Presentations

Ethical issues in robotics: Professor Noel Sharkey, University of Sheffield  
Social and health care robotics: Professor Kerstin Dautenhahn, University of Hertfordshire  
UK space robotics: Dr Dave Barnes, Aberystwyth University

### **4.25pm** Chair's remarks

### **4.30pm** Discussion and demonstrations of robotics research in the UK

### **5.45pm** Close

## **Speaker Presentations**

### **UK Space Robotics**

Dr Dave Barnes from Aberystwyth University will discuss the UK's heritage in space robotics and the investment success story of Beagle 2, a UK led mission, and the first planetary robotic spacecraft in Europe. "We may have lost Beagle 2 but we didn't lose the UK science and engineering expertise that did get Beagle 2 all the way to Mars – and we must not lose this investment." He will talk about the UK's major role in the next European mission to Mars called ExoMars, where the UK is responsible for delivering the ExoMars rover. He will close with an overview of the future for UK space robotics and draw attention to the needs of industry and universities, now and in the future to sustain and grow the UK space robotics position within Europe.

### **Social and Health Care Robotics**

Professor Kerstin Dautenhahn from the University of Hertfordshire will talk about current significant research activities in using robots in rehabilitation, therapy and education. She will highlight the growing advancements in using Robotics and Artificial Intelligence techniques to develop socially interactive robots and new developments in using interactive robots that are useful and behave socially, for example as robotic helpers for elderly people or in robot assisted play therapy. Professor Dautenhahn will also draw attention to the need to develop research prototypes into products that are available to the users.

### **Robot Ethics for the 21st century**

Professor Noel Sharkey from the University of Sheffield will highlight the rapid increase in the number and variety of robots in the market place over the last couple of years. He will explore the big newcomers – 'the professional and personal service robots' showing how they are set to clean our houses, pick our crops, serve our petrol, entertain us, perform surgery on us and even care for us in illness and old age.

“All the technology is in place at last to fulfil the predictions of our forefathers and it is now just a matter of being creative. But like every great discovery, there are always concerns about how it will be applied. Will it be good for everyone?”

Professor Sharkey will give examples of some of the moral and ethical dilemmas that could face us in the near future and suggest that the UK needs to make policies now rather than let the policies make themselves.

The examples he will draw attention to are care for the elderly, child care, military deployment and the implementation of military technology into civilian life for surveillance and policing.

## **Speakers**

### **Professor Noel Sharkey**

Noel is a Professor of Robotics and Artificial Intelligence and Professor of Public Engagement as well as an EPSRC Senior Media Fellow at the University of Sheffield. He has moved freely across academic disciplines, lecturing in departments of engineering, philosophy, psychology, cognitive science, linguistics, artificial intelligence and computer science, publishing over 100 academic articles and books. He is known for innovative museum exhibitions and travels the world giving public lectures. He appears regularly on Television (over 280 programmes), radio and in the press. In addition to this, Noel is Editor-in-Chief of the journal Connection Science and an editor of both Robotics and Autonomous Systems and Artificial Intelligence Review. In his role as an EPSRC Senior Media Fellow he is focussing on issues of concern to the public and the ethics of robot applications. Noel is currently pursuing a number of urgent issues surrounding the military application of autonomous weapons.

### **Professor Kerstin Dautenhahn**

Professor Kerstin Dautenhahn received her Ph.D. degree from the Department of Biological Cybernetics at the University of Bielefeld, Germany. She is Professor of Artificial Intelligence in the School of Computer Science at the University of Hertfordshire where she coordinates the Adaptive Systems Research Group. Her current research focuses on Human-Robot Interaction and Social Robotics. She has pioneered research in robot social learning and imitation, and the study of robots in autism therapy. She has published more than 150 research articles on social robotics, robot learning, human-robot interaction and assistive technology. Professor Dautenhahn has edited several books and frequently organises international research workshops and conferences. She is involved in several European projects (Cogniron, Robotcub, Iromec, eCircus, LIREC, I-Talk) and is Editor in Chief of the journal Interaction Studies: Social Behaviour and Communication in Biological and Artificial Systems.

### **Dr. Dave Barnes**

Dr. Dave Barnes is Head of Space Robotics at Aberystwyth University, and holds the position of Reader in Space & Planetary Robotics (2005) within the Department of Computer Science.

Dave has been a member of the UK STFC Aurora Advisory Committee (AurAC) since 2005, and represents the interests of the UK EPSRC community on issues relating to the ESA Aurora Programme and Planetary Exploration. He is a founding member of the UK Space and Planetary Robotics Network, and is a member of the UK STFC Particle Physics, Astronomy and Nuclear Physics Science Committee (PPAN).

Dave is also a member of the ESA Mars Express consortium, and was responsible for the Beagle 2 Lander robot arm calibration, software modelling, simulation, and visualisation for planning and arm commanding purposes during the mission.

He is currently a member of the ESA ExoMars rover team, and is researching autonomous science sample acquisition methods for the ExoMars mission.

Dave has been active in robotics research for 25 years, and has been a PI on numerous projects funded by the EPSRC, STFC, Royal Society, and European projects including ESA. His ESA work involves the research and development of aerobot technology for planetary exploration. Dave's research interests include intelligent computing methods for autonomous robot enabled planetary science, and novel computer vision methods for increased planetary science return.

## **UK could lead the world in robotics**

Experts including Bill Gates, have commented that the robotics industry today is where the PC industry was 20 years ago and tip it to become as pervasive in the future.

The UK is a leader in the development of robot systems particularly in the field of 'professional service robots' that:

- assist surgical teams
- conduct space exploration
- undertake environmental monitoring and sub-sea exploration
- service nuclear power stations
- carry out bomb disposal servicing
- maintain sewers, roads and pylons

In the next 25 years, the 'service robot' market is predicted to boom and with the right support for small companies and university spin-outs, Britain is in a strong position to take a leading role.

## **Robotics and the Economy**

- The worldwide industrial robot market is currently worth \$6bn - rising to \$20bn once support services are factored.
- The service robot sector grew by 40% between 2005 and 2006 and the Japan Robot Association predicts that the 'service robot' market by 2025 will be worth \$80bn.
- The UK professional service robot market comprises over 50 companies including about 28 advanced robotic SMEs.
- Robotics in the UK is a great example of successful university and industry partnerships.

## **Robotics and Society**

- Robots benefit people's lives. Robots developed in the UK are helping children with autism and undertaking other therapeutic tasks.
- As our population ages, robots performing domestic, therapeutic or care tasks for the elderly will become increasingly important to the UK economy.
- Leading researchers in the UK at the University of Hertfordshire and the University of the West of England are paving the way for the next generation of these user-friendly robots.

## **Skills for the Future**

- We need to nurture UK physics and engineering talent to transfer science into benefits for UK industry and society.
- Robotics is a great platform for teaching all the sciences and engineering in school. Robotics challenges children to think across the scientific disciplines and work in teams to create effective robots.
- A large number of experts working in robotics have an educational background in physics.

## **Exhibitors**

### **1. Medical Professional Service Robots - Imperial College and Acrobot**

Dr Ferdinando Rodriguez y Baena and Dr Michael Lamperth from the Mechatronics in Medicine Laboratory at Imperial College along with Acrobot (a spin-out of Imperial College) a world leading provider of computer-assistance for orthopaedic surgery have developed robotic technology used to assist orthopaedic surgeons in joint replacement surgery. Acrobot's robotic systems assist surgeons to achieve the best position and orientation of orthopaedic implants for superior clinical outcomes for the patient.

Imperial has also developed a prototype of an MRI compatible robot for transrectal prostate biopsy a system which can operate directly in the restricted space of an MRI scanner and offer much better accuracy.

### **2. Humanoid Service Robots - Bristol Robotics Lab and Elumotion Ltd**

An important part of human / robot interaction is for people to feel they are engaging with an 'intelligent agent'. Craig Chorley and Martin Pearson from The Bristol Robotics Laboratory along with Craig Fletcher and Dr Graham Whiteley from Elumo-

tion Ltd have been working on research exploring robot gesturing, artificial empathy in robots and haptic sensing for physical interaction between humans and robots.

### **3. Robots for Oceanographic Monitoring - University of Aberystwyth**

The changes facing the planet in relation to warming seas make oceanographic monitoring essential. The group at Aberystwyth are working on an autonomous sailing boat for this purpose; the boats have an advantage over the traditional techniques in that they actively maintain or seek a global position and can return to a fixed point if they are damaged.

### **4. Robots in Space - University of Aberystwyth, EADS Astrium and SciSys**

A big question for science is: "Is there, or has there been, life on Mars?" In 2013 a European Space Agency rover called ExoMars will be launched on a journey to find out. ExoMars is part of the ESA Aurora exploration programme. This is a long-term plan for the robotic and human exploration of the solar system with emphasis on Mars, our Moon and the asteroids. ExoMars is the first Aurora Flagship mission. Of the 14 nations participating in Aurora and ExoMars, the UK is the 2nd largest contributor. The University of Aberystwyth, EADS Astrium and SciSys are all working on the Mars rover.

### **5. Robots as social mediators and home companions - University of Hertfordshire**

Robots carrying out domestic, therapeutic or care tasks will become increasingly important to the economy. Current Human-Robot Interaction research is helping to inform the next generation of these user-friendly companion robots. The University of Hertfordshire has one of the most experienced HRI research teams world-wide. The UH team has designed and built a humanoid Kaspar robot that they use in different European robotics projects and in their work with children with autism and a peoplebot, a human-sized robot used in studies on robot home companions.

### **6. Robots in education - Open University and University of the West of England 'Walking with Robots' Network**

The Open University Robotics Outreach Group coordinates RoboFesta-UK a robotics education programme. RoboCupJunior UK, part of RoboFesta-UK is a school's initiative that offers several challenges including dance, rescue and soccer each encouraging the pupils to work together in teams to create effective robots.

Led from the Universities of the West of England, Essex and Sheffield, the EPSRC-funded Walking with Robots network brings key intelligent robotics researchers together with leading science communicators to promote a wide public engagement with the reality of contemporary robotics research and with the people who do that research.

### **7. MOD Grand Challenge: Autonomous flying micro air vehicles - University of Essex and Swarm Systems Ltd**

Swarm Systems Ltd leads one of only six teams funded by the Ministry of Defence to compete in the UK Grand Challenge. As well as the University of Essex, the team includes another top UK university and several small specialist UK companies. The task is to create a system that can detect, identify, monitor and report a comprehensive range of military threats in an urban environment. The Swarm Systems strategy is to deploy a swarm of small flying machines known as Owls, equipped with cameras to search for potential threats.

### **8. Humanoid Robotics Technologies - Shadow Robot Company**

Shadow Robot Company have been developing innovative humanoid robotics technologies for over 20 years. Based in London, Shadow are a UK success story with over 230 customers in 30 countries including NASA and Carnegie Mellon.

Shadow specializes in remote manipulation and have developed robots that can be used around or in place of humans to perform tasks in dirty or dangerous environments.

Shadow is currently working on medical, industrial, animatronic, performance and research projects, as well as developing technology for use in space, nuclear and bio-hazard work.

Shadow have developed the C5 Dextrous Hand, the only robot hand available anywhere in the world with the same movements as a human hand. Shadow is currently refining and improving the design for rugged industrial applications.

#### **Further information**

If you would like to know more about the exhibits or robotics research in the UK, please contact:

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