Robots of the future

An early interest in science fiction sparked Dr Elizabeth Broadbent’s lifelong fascination with robots. Here, she discusses a career that has spanned engineering and psychology, and her ambition to oversee the development of more acceptable robots.

How did you become interested in human-robot interactions?

*Star Wars* made a big impression on me when I was small – I loved the personalities of the robots, their humour and their conscientiousness. As a teenager, I read the novels of Isaac Asimov and Harry Harrison, and I dreamt of making Giskard and Daneel, robots from Asimov’s books who were so loyal and caring to humans. To this end, I started with an honours degree in Electrical and Electronic Engineering, before going on to work for a small New Zealand company called RoboTechnology. However, I was frustrated by the limitations of technology and robots at the time.

What were these limitations, and how has your career path brought you closer to overcoming them?

When I first graduated from engineering school the only robots being made were very mechanical and performed factory-type tasks. They did not interact with humans very much and were essentially just machines. This was frustrating because I wanted to make robots that could think, feel and interact with us on a personal level, and I particularly wanted to make robots that could care for people who were unwell and needed support.

To better understand how to give robots thoughts and feelings, I studied how people think and feel. I went back to university and obtained my PhD in Health Psychology. This, combined with my engineering background, sets me up well to make robots that are not only technically sound but also acceptable, which is important in ensuring people are comfortable around them. One way in which my research has furthered knowledge in this field is studying how robots’ appearance, voice and behaviour affect people’s reactions to them.

Could you pinpoint the key factors involved in developing robots for healthcare purposes and some of your greatest successes to date?

The key factors are making robots look good, simple to operate, responsive and reliable – all of which will make people more accepting of them. On top of that you need to make the robots perform a useful task. Our largest project to date involved the deployment of 35 autonomous robots at Auckland’s Selwyn Village retirement community. Some of the tasks they did were to remind people to take medication; play music and memory games; take blood pressure and pulse oximetry; and use Skype in a simple way. In the four-month trial, we demonstrated that healthcare robots are feasible and acceptable for both staff and residents, and that companion robots can reduce loneliness in older people.

Another of your projects focuses on robot aesthetics. Why do you think robot features can sometimes be perceived as ‘creepy’, and how are you addressing this issue?

Robots can appear creepy because they do not fit into the category of human or machine. They might look human-like, but the way they move, talk or feel isn’t quite right, and this can create unease. We are trying to address this issue in a few ways – first, by making robots more human-like so they do not look unnatural, and secondly, by avoiding the situation where robots look half human and half machine. They can look human-like or machine-like, but not a scary mixture of both.

Besides healthcare, will your research have any other applications?

At present, my focus is on healthcare, but there are potential applications for robot acceptance findings in many other areas, such as in industry and domestic situations. We are poised on the brink of seeing robots in many different areas, and we need to find out more about what makes them acceptable in these applications. Most of the grant money in robotics to date has gone towards making robots more technically advanced, but more efforts need to be dedicated to investigating the factors that promote acceptance in order to see the projected robotics boom realised.
Escaping the uncanny valley

An international team based at the University of Auckland, New Zealand, is looking at the interface between humans and robots in a bid to make the widespread adoption of these machines in healthcare a reality.

ROBOTS HAVE LONG caught the world’s imagination through futuristic stories played out on screen and in literature in which they are often portrayed as the servants or helpers of mankind. Indeed, much of the modern study of robots is inspired by these works of fiction. In one sense, servile robots are already a significant presence, as they are utilised in a variety of applications ranging from factory work to military purposes. However, these robots are a far cry from the intelligent, often humanoid robots of fiction.

The silver face is seen as more ‘eerie’ than the human-like face.

While robotics has not yet reached the extraordinary heights of these stories, there have certainly been enormous advances in the field in recent years, with pioneering teams producing highly complex androids such as the Actroid and the HRP-4. Such projects are undoubtedly incredible feats of engineering, but the practical applications of these robots tend to be either highly idiosyncratic or non-existent. To truly realise the vision laid out in science fiction, there is a need for robots that are not only capable of interacting with humans, but also serving specific functions.

CARING ROBOTS

One area that has been flagged as suitable for the implementation of robots has been care of the elderly. Developed countries are currently facing the problem of an ageing population, a phenomenon that results in a large proportion of older people in need of care. In response to this need, several projects have focused on developing robots that provide assistance, health check-ups or company to the older generation. One such project is being undertaken at the University of Auckland, New Zealand, where an international collaboration with a number of Korean robotics institutions has been developing and testing healthcare robots for older people since 2008. Dr Elizabeth Broadbent, who leads the Human-Robot-Interaction aspect of this initiative, has brought her passion for robotics and human psychology to the table in an effort to create robots that provide tangible benefits for the elderly. Working in partnership with The Selwyn Foundation, a non-profit organisation providing residential care, retirement living and community services for older people, the team has run extensive studies to determine the functions that robots should perform, as well as people’s reaction to them.

These trials proved highly successful, with robots helping everywhere from the café to the dementia care unit at the Foundation’s Selwyn Village retirement community. The robots provided useful functions that ranged from playing games to giving reminders about taking medication, and the team’s studies have led to further work exploring whether similar efforts can help to supplement resources in rural areas. Not content with resting on their laurels, however, the team also recognises that there is still room for improvement.

IMPROVING AESTHETICS

While the Auckland group’s studies have shown that robots possess the technical capabilities to provide useful services in healthcare, Broadbent feels that there is an often overlooked hurdle when it comes to their implementation, and that is people’s perception of them. In fact, the very stories inspiring so much of robotics have also proved its downfall in this respect, as they instil preconceived notions in people’s minds: “Though most individuals have never interacted with a robot in real life, they have mental schemas about what robots should do, what they should look like, and what their abilities should be,” points out Broadbent. “These mental schemas act like a pair of tinted glasses.
One particularly noteworthy success for the retirement village residents was PARO, a fluffy baby seal robot developed by Japanese industrial automation company AIST. A randomised controlled trial carried out by the team showed that it significantly reduced loneliness in the elderly population of the complex, serving this function even better than the resident dog.

indispensable. Research has shown that people tend to treat these machines in an unusual way: “Humans are social creatures and we are used to interacting with other people and animals,” explains Broadbent. “It appears that we automatically respond to computers and other technologies in the same ways that we interact with other people.” In a natural extension of her research, Broadbent decided to examine how this attitude to other technologies compared to people’s reaction to robots – specifically whether robots elicited a more positive reaction. This research is important, as robots are more expensive than computers so they need to have demonstrable advantages if they are to be rolled out in a healthcare setting.

Broadbent and her team set up a trial in which people were given either a robot – namely the loosely humanoid iRoBiQ – or a computer tablet as an exercise coach. The same software was run on both devices, instructing participants to carry out some basic exercises and asking them questions. Intriguingly, people were more likely to obey the instructions when issued by the robot, and their general perceptions of it were much more positive, with many expressing the desire to interact with it again. This study presents a tantalising glimpse of the potential that widespread adoption of robots could have for healthcare.

Having implemented robots in a trial healthcare environment to great success, Broadbent and her collaborators are excited about broadening the scope of their operations, and they already have one project in the pipeline. “Our next big project is investigating whether robots can reduce hospitalisations in patients with chronic obstructive pulmonary disease,” she enthuses. However, she is also dedicated to the much wider task of influencing human perceptions and behaviour around robots by experimenting with their aesthetics. Work in this area will help to bring the interactive robots of fiction one step closer to real life.