



Chronically Sick and Disabled Persons Act 1970

***Research and Development Work
Relating to Assistive Technology
2002***

Presented pursuant to c.44 1970 Section 22

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Introduction

This report is produced pursuant to Section 22 of the Chronically Sick and Disabled Persons Act 1970. It outlines a selection of the research and development activity relating to assistive technology funded by the government in 2002. The work has been grouped into categories which were selected because of the quantity and quality of work undertaken in each one last year.

Full details of all the work funded are available on the Foundation for Assistive Technology (FAST) website (www.fastuk.org), together with information on research funded by other sources. FAST also produce a document outlining funding streams available for assistive technology research and development. Copies of National Service Frameworks (NSFs) and other Department of Health publications are available on the Department's website (www.doh.gov.uk).

Children with autism

In March 2003 the National Autism Plan for Children was published by the National Autistic Society in collaboration with the Royal Colleges of Psychiatrists and of Paediatrics and Child Health, with the backing of the All Party Parliamentary Group on Autism. This report sets out guidelines for assessment, diagnosis and intervention in early life and will inform the development of the autism exemplar in the forthcoming National Service Framework for children. The report provides a guide to current best practice in intervention and therapy for children with autism/autism spectrum disorders (ASD) and highlights the importance of good evidence on effectiveness.



Some research is exploring how new technologies can be used in interventions for children with autism/ASD. Since 1998, the Aurora project has investigated the use of robots in playful, social environments for the benefit of children with autism. The purpose is to engage a child in therapeutic behaviours such as turn taking and imitation. The robots are intelligently designed as a teaching device with simple interaction skills such as imitating the arm movements of a child. Trials taking place at the Radlett Lodge School, a school of the National Autistic Society, have demonstrated the value of robots as a social facilitator and in assessing the interaction competencies of the children. Researchers at the Universities of Hertfordshire and Reading have been supported by the Engineering and Physical Sciences Research Council (EPSRC).

The European Commission is funding a project to create a multisensory portable system that children with ASD will enjoy using to interact with the environment through touch, sound and sight. The new expressions that the system will elicit from the children will also promote an understanding of the autistic world for families, carers, teachers, and researchers.

Prototype component parts (image, vibration, sound and intelligent software) have been integrated with the physical structure and evaluation trials are taking place in the UK, the Netherlands and Spain. The project is led by the University of Portsmouth.

Learning disabled people

There are 210,000 people with severe and profound learning disabilities in England. In March 2001 the Government published the first White Paper for 30 years *Valuing People: a new strategy for learning disability for the 21st century*. The White Paper highlights the role of new technology in meeting the communication needs of people with severe learning disabilities. Some learning disabled people also have a physical disability or sensory impairment and assistive technology can enable them to have increased control, choice and independence.

Augmentative and Alternative Communication (AAC) is the term for methods of communication which can be used to add to the more usual methods of speech and writing when these are impaired. Joan Murphy in the Dept. of Psychology at the University of Stirling devised an AAC framework called Talking Mats™ (literally mats with pictures attached) during a research project funded by the Scottish Executive Health Department. It is an interactive resource that uses three sets of picture symbols - topics, options and visual scale.

1. **topics**, whatever you want to talk about. For example, *what do you want to do during the day, where you want to live, who do you want to spend time with*, etc.
2. **options** relating specifically to each topic. For example, whether you want *to go to college, attend a day centre, stay at home*, etc.
3. **visual scale** in order to allow participants to indicate their general feelings about each topic and option. For example, whether they are *happy, unsure, unhappy*.

A new Talking Mats™ package has been designed specifically for learning disabled people and incorporates the thoughts, ideas and discussions which have evolved from both clinical and research experiences since the production of the original Talking Mats™ training package. Run jointly between Forth Valley Primary Care Trust and the AAC Research Unit at the University of Stirling, training is offered to anyone who is involved in work with learning disabled people with a communication impairment.

The Accessibility Research Group at University College London is collaborating with Hackney Community Transport to investigate and develop a hand-held device to provide information to learning disabled people about a journey they are planning or making. The device will give location-based instructions and other information delivered in a user-friendly way through a combination of video clips, cartoons, photos, and sounds. The project is funded by the Department for Transport and follows a feasibility study funded by EPSRC.

Spinal injury and paraplegia

The Department of Health plans to publish the new NSF for Long Term Conditions at the end of 2004 with a 10-year implementation period from April 2005. The NSF will provide a framework for emerging treatments and new approaches to managing neurological disease and brain and spinal injury. The aim of the NSF is to improve the quality of life of people with these conditions. The NSF will also look at some broader issues important to people living with disability, including access to community equipment, assistive technology and wheelchairs.

Last year's Section 22 report described the development of a cycling system to allow people with paralysed legs to use their own muscles to propel a tricycle. The system uses Functional Electrical Stimulation (FES) to contract the muscles. Participation in a regular programme of FES cycling exercise may lead to a range of medical and health benefits including improvements in cardiopulmonary fitness, tissue condition (soft tissue and muscle), and bone integrity. Previous studies have been clinic-based, but EPSRC is now making nearly £0.5 million available for a multi-centre study in which people with spinal cord injury will be given intensive training at home. The research team will also document the tricycle system as a design specification, in preparation for commercialisation.

For the first time, engineers have enabled paralysed people to stand up and balance for significant periods without holding an external support. This is an important breakthrough in helping individuals with spinal cord injuries to start standing again for useful lengths of time - standing for up to seven minutes has been achieved in experiments. The cutting-edge research project that achieved this advance was carried out by the Department of Mechanical Engineering at the University of Glasgow with funding from EPSRC. The project focused on techniques that use low levels of pulsed electrical current to stimulate the nerves that control muscle movement. The University of Liverpool is participating in a €1.75 million (£1.2 million) project funded by the European Commission studying the use of electrical stimulation to enable people with longterm flaccid paraplegia to stand. The project will aim to restore muscle fibres, mass and function and assist the patients' ability to rise and maintain a standing posture. While some other work (such as the FES cycling project mentioned above) is concentrating on innervated muscles which no longer communicate with the brain, this project focuses on denervated or flaccid muscles. Making the muscles bigger increases blood flow and skin quality, and may reduce the incidence of pressure sores.

Artificial hands and arms

Every year there are over 250 new referrals of upper limb amputees to prosthetics service centres in the UK. Recreating hand and arm functionality presents immense scientific and technological challenges and UK researchers are actively developing new and improved prostheses to address amputees' needs.

Edinburgh's Bioengineering Centre has been in the forefront of research in artificial arm prostheses. The Centre, currently part of Lothian Primary Care NHS Trust, has carried out development work on the Edinburgh Modular Arm System (EMAS). Now a spin out company, Touch EMAS, has been formed from the trust. A SMART award from the Scottish Executive, and seed investment from the private sector, will enable the company to accelerate its development and manufacture of the four components of the modular system (shoulder, elbow, wrist and hand).

People manage the subtle control of their hands by integrating the information they receive from their hands with visual data. A project funded by EPSRC at the University of Reading is studying whether appropriate feedback to the user of a hand prosthesis through transducers can improve control.

An ongoing programme of work on the Southampton University artificial hand is being carried out at the university's Department of Electronics and Computer Science. Novel mechanisms, controls and sensors are being investigated. EPSRC has recently contributed funding for three years, allowing force sensors to be added to the finger, thumb and palm surfaces. The development of the prototype is continuing.



The European Commission is funding a €1.69 million (£1.2 million) project to increase knowledge of neural regeneration and sensory motor control in the hand. The expected result will be the development of a new kind of hand prosthesis which will re-create the natural link between the hand and central nervous system (CNS). The new 'cyberhand' will process nerve signals from the CNS and provide feedback by stimulating peripheral nerves which send signals back to the CNS.

Incontinence

Urinary incontinence affects physical, psychological, and social wellbeing, and impairs quality of life. It is eight times more common in women than in men, and in 1990 the number of women in the UK suffering from this condition was estimated at 2.5 million. A survey of continence product use in residential settings published in February 2003 by the Medical Devices Agency (now part of the Medicines and Healthcare products Regulatory Agency) found that around 70% of nursing home residents and around 35% of residential home residents have a continence problem that merits the use of a continence product.

The Department of Health has awarded a grant of £0.48 million to the Department of Medicine at University College London (UCL) to conduct a comparative evaluation of key categories of absorbent products for urinary/faecal incontinence. These products account for the majority of expenditure on incontinence aids and appliances in the UK. They are available in several different designs (such as diaper style, insert pads, pull-ups) and materials (disposable and washable). Currently, there is very little published evidence about the

comparative performance of these different product categories to guide product purchase. A database is being compiled with the following objectives:

- to compare the performance and cost-effectiveness of the key absorbent product categories;
- to develop an instrument to measure quality of life for people using absorbent products.

Other research being conducted in the Continence Technology Group at UCL includes the EPSRC funded development of a new predictive mathematical model for designing improved reusable incontinence bed pads. Also, a study into urinary incontinence and skin health provides recommendations for the appropriate selection of absorbent continence products to reduce the risk of pressure ulcers.

About 40,000 patients in the UK are undergoing long-term catheterisation to aid bladder management. The presence of a catheter in the bladder induces vulnerability to infection, which can result in the formation of encrustations on the catheter. These deposits can obstruct the flow of urine inducing retention or leakage. If the problem is not detected quickly the bacteria can cause kidney infection, septicaemia and shock. To address this, the Cardiff School of Biosciences is leading a £0.5 million project to develop a sensor to signal the initiation of crysalline biofilm formation on urinary catheters. The Department of Health is meeting half the costs of the project and this funding is matched by industry.

Brunel University is leading a €2.3 million (£1.6 million) project receiving funding from the European Commission to develop a continence management system suitable for use by people who are immobile or have limited mobility. The system consists of two different interfaces - a small female urinal and a small body worn pad. This will allow patients to manage their continence needs independently by providing a method of transporting urine away from the body and storing it in a purpose made container. The project began in 2003 and follows on from two earlier projects that were carried out by Brunel University and funded by Action Research. In these earlier projects, the Active Urine Collection Device (AUCD) was constructed and earlier prototypes tested.

Stroke rehabilitation

The EU funded GENTLE/S robot assistance project has been set up to provide both diagnostic and therapeutic help to people who, following a stroke or traumatic brain injury, have lost the function of an arm. Strokes are a leading cause of disability and affect around 200 in every 100,000 people for the first time each year. The incidence rises rapidly in older people with two thirds of those affected being over 65 years of age. Around 65% of people survive, some with severe impairment, and it has been shown that early, intensive and task oriented therapy can improve the outcome for each individual.



The GENTLE/S robot provides therapy for upper limbs which is tailored to the individual patient's needs. This is done via real tasks using an active grasping mechanism at the end of a robot arm, and also through virtual reality with computer graphics where the user manipulates objects on a computer screen through a simple 'reach and touch' technique. The robot teaches the correct movement pattern using a video clip of the user in action showing the patient how the task should be performed and what errors should be avoided. The patient's physiotherapist customises the exercise to each user's specific needs and selects the appropriate level of assistance required. For the virtual tasks, different computer 'wizards' can be implemented to interact with the user, each having a personality defined and assigned according to the user's background, age, sex, culture etc.

One of the main problems for stroke victims is that the ability to open the hand is lost. It has been shown that FES can be used to open the hand to allow basic function. To date this has been done using skin surface electrodes with the inherent problems of electrode positioning and sensory stimulation. These problems can be overcome using an implanted device. A two channel implanted FES device is under trial for the correction of dropped foot. This device could be utilised in the upper limb, requiring only a redesign of the external components and minor changes to its electrodes. A project funded by EPSRC started at Salisbury District Hospital in August 2002. A micro controller based external device has been created and for testing purposes it also drives an external stimulator. Electrical tests are in progress and it is expected that clinical trials with the external device will begin with patients in the near future.

People with aphasia (a communication impairment that can occur after stroke) can experience difficulties in resuming work and leisure interests, maintaining relationships, and gaining access to information and support. The Economic and Social Research Council has funded a project on inclusive Internet technologies for people with communication impairment as a joint initiative between the charity Connect, The Department of Language and Communication Science at City University and the Department of Computing at the University of the West of England. It explored the potential of the Internet as one means of dismantling these barriers via the creation of an aphasia support website. This was used to determine the needs of people with aphasia in relation to accessing Internet-based information, and creating and joining virtual communities.

Dementia

Approximately 600,000 people in the UK have dementia and this figure may double by 2050. Over a quarter of these people live alone. Dementia affects the ability to use words and to carry out previously familiar tasks, like getting dressed or making a cup of tea. It affects recognition of places, people and objects, and people with dementia often feel lost in terms of time and place. The ENABLE project funded by the European Commission is developing and trialing technology products to find and promote those which best support people with



dementia. The Bath Institute of Medical Engineering (BIME) has developed several new devices in the project, including a locator for lost objects (shown opposite), a bath water level temperature monitor and controller, a cooker usage monitor, and an automatic bedroom light. Devices developed by European partners include a night and day calendar that automatically changes date and time. Meetings with carers' groups, voluntary organisations, social services and community mental health teams in the UK have been used to generate interest and recruit participants. A product listing with purchase details is available on the project website at www.enableproject.org.

Some of the products mentioned above have been installed in the Gloucester Smart House. In this EPSRC-funded project, the BIME is collaborating with Dementia Voice and the care home business Housing 21 to create a fully equipped demonstrator home to enable care professionals to see the potential of technologies to support people with dementia. The Smart House uses an integrated communications system that controls and monitors the different devices.

A new phase of the research is studying 'intent to wander' amongst people with dementia. In the Smart House, a bedside light comes on when a person with dementia rises from their bed during the night. A text message is sent to the carer and a prompt will be given to the individual as a reminder to return to bed. The research is considering the psychological nature of prompting and will examine the most effective method of communication with the person with dementia and the best timing for this prompt. Possible prompts include a blast of air, a clock face displaying the time, or a familiar voice recording.

The NHS R&D Health Technology Assessment Programme is commissioning a systematic review of the effectiveness and cost-effectiveness of methods to detect and manage wandering in dementia. It is intended that the review will consider the acceptability of the technologies, the ethical issues raised by their use, and the implications of these factors for future research.

EPSRC has recently awarded over £600,000 for a three-year collaborative project that will investigate enabling domestic environments for people with dementia. The project brings together two universities, two companies, Northampton County Council and Dementia Voice, and will involve users at all stages. The potential of technologies to support older people with dementia will be assessed, and design and technology solutions outlined. New assistive technologies, as well as service and business models for their implementation, will be developed.

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The report is available on the Department of Health's R&D website:
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