The Royal Academy of Engineering

Scientific Aspects of Ageing

**Response from The Royal Academy of Engineering to the
House of Lords Select Committee on Science and Technology**

October 2004

1. Biological Aspects of Ageing

1.1   What are the promising avenues for research?

1.1.1 Some of the most promising avenues for research lie in developing diagnostic tests which enable the individual to maintain checks on their own health status or to enable cheap and efficient regular screening programmes to be established. A significant burden could be removed from the health service by individuals carrying out basic monitoring of their own health in the home on, say, a daily basis. Technology already exists which allows the monitoring of blood pressure, ECG, respiration etc using simple to operate devices and software. This allows the logging of information which is then sent in compressed form to, for example, the GP's surgery. The software detects deviations from the normal pattern of results; hence there is no need for the GP or nurse to monitor each trace. In the case of hospital based scanning and analytical tests, potential developments to increase accuracy and reduce the price of such tests would be a great advantage. Any such improvements in the accuracy of the techniques would apply not only to the ageing population and could facilitate routine sampling that leads to early diagnosis of debilitating diseases.

1.1.2. Current research strands which will potentially offer interesting future developments and are important to note are:

    a. The sensor specialist company e2v Technologies has entered into a partnership with Brunel University for image sensing technology. There will be projects for six PhD research students and additional staff and this work will commence in October 2004.

    b. A Cambridge-based firm, Astron Clinica, has recently produced a product, SIAscope (Spectrophotometric Intracutaneous Analysis) which uses visible light in a scanning process to detect melanomas. In parallel the Biomedical OpticsResearch laboratories at University College London is using infrared tomography to analyse the oxygenation state of tissue in the brain.

    c. Teraview of Cambridge is developing analytical methods to detect Basal cell carcinoma using terahertz radiation.

1.1.3. All of the technologies quoted above would assist in speeding up the identification of physical or biological change associated with the onset of disease and could be carried out at high speed and low cost needing fewer people, trained to a lesser degree to operate the equipment. Present imaging techniques require a high degree of training and the time taken for scans varies depending on the type of and complexity of the requirements.

1.1.4. The vast majority of the elderly fall into two categories, those are that are physically able but mentally impaired, and the reverse. There is therefore, a need to carry out research on how domestic devices can be modified to meet these requirements. If carried out properly for those people with only physical problems, these modifications could be of benefit to the whole of society.

1.1.5. There is also great promise in harnessing the benefits of communications and remote monitoring systems to enable greater independence for the elderly citizen. A recent DTI Foresight study on the Exploitation of the Electromagnetic Spectrum showed how mobile communications and remote sensing technology could open up the opportunities for early and/or remote healthcare monitoring. In addition to this, the development of communications media which compensate for reduced ability to hear or to write (text to speech/speech to text) could enable an older person to continue to take part in mainstream society with minimal external assistance.

1.2 How will such research benefit older people and delay the onset of long-term illnesses and disabilities?

1.2.1. Early diagnosis can be vital in improving the effectiveness of the treatment of many life threatening conditions. The detection of changes in blood and tissue in the early stages can often lead to arresting or preventing further onset of disease. In order that early diagnostic tests are carried out regularly it is essential that an education process be established to make so that older people aware that they need these check-ups. Swift identification of developing conditions will avoid complex treatments later on.

1.2.2. Technological developments will benefit older people by increasing their available lifestyle choices for a greater number of years. Technology can extend the period of independent living and also allow the delivery of medical care and support at home. This has important consequences for lessening the burden placed on the NHS to provide hospital based care.

1.3 What are the consequences of the biological differences between the sexes, different social backgrounds and ethic groups within the UK?

1.3.1. Women have a greater life expectancy than men and are therefore more likely to need to access services for longer and more likely, in cultures where the nuclear family unit prevails, to live alone following the death of a spouse. In cultures where living in extended family units are more common, there is a greater likelihood of the effects of the death of a spouse being alleviated to a certain degree by the support of younger family members. Although the older members of the family can rely on the support of the relatives, the family as a whole may need support to adapt their lifestyle in order to accommodate the needs of an older person within the family unit.

1.3.2. As the population of the UK ages, it becomes more important to change the perception of "elderly" as a unique condition needing specific age-related developments – the effects of ageing must be thought about within the whole range of human conditions. It is not correct to consider people today on the basis of their biological age. Some people in their late 70s are physically and mentally more active than others in their 50s. Many vital consumer goods could be redesigned to meet a wide range of users without compromising their performance or making them less suitable for 'able-bodied' people

1.3.3. It must also be noted that any study of age must remain mindful of both the genetic issues (nature) as well as the influence of life-style and society (nurture) on seniority and the ageing process. The two shaping forces must be considered in unison, as they are inseparable, in order to create a valid picture of the impact of ageing – not merely biology alone.

2. The application of research in technology and design

2.1   Employing existing technologies to give greater benefit to older people

2.1.1. There is a great deal that can be done to develop existing technologies for the benefit of older people. For the purposes of this response, we have considered where technology can help in four particular life aspects:

2.1.1.   *a. Facilitating living in, and maintaining one's own home and garden*
For an older person, having to leave their home is, in any event, a cruel loss of independence; it can also be seriously disorientating. Simple measures could be employed to allow the long term use of the family home, well into old age. These could include: houses built with flexible internal layouts to allow bedrooms to be moved to the ground floor level; a centralised vacuum cleaner with localised points in every room; high-level sockets; standardised plugs and taps; improved cooking aids and domestic cooking devices utilising "fail-safe" sensor technology which automatically turn off electricity or gas supplies should a saucepan boil dry; household appliances and furniture made lighter or at least easier to move; higher-level flower beds, and increased developments of robotic lawn mowers would assist in maintaining an independent existence. In addition to this, electronic and IT-based security systems could monitor safety devices (for example, for detecting falls or for monitoring respiration and blood circulation during sleep). IT is also able to provide healthcare monitoring facilities from home, reducing the need to travel to a doctor's surgery or hospital.

2.1.1.   *b. Facilitating a continuing intellectual life.*
Lifelong learning opportunities to develop new interests or extend existing ones would encourage individuals to remain active. The situation when retirement at 65 no longer means the withdrawal of an individual from the majority group in society will require maintaining and prolonging the intellectual capability of the person as this is vital to promoting good mental health. Computing software designed specifically for the needs of the elderly could help to maintain active engagement with the developing world, as well as helping the individual to remain mentally alert. For the elderly who are not mentally impaired there is a great need and often desire to keep up with modern technology such as web technology, mobile phones etc. For the young and middle aged this technology is incorporated into their lives through peer group usage at work, university etc. This is often not the case with the elderly because they do not tend to mix so often with groups using these devices. It is therefore important to carry out research as to how to access and provide easily understandable information.

2.1.1. *c. Enabling mobility*
Continued development of mechanical/mechatronic aids will help people with mobility problems - for example, better wheelchair designs which can tackle steps or improved walking aids.

2.1.1. *d. Enabling communication*
As previously discussed, the loss of hearing, speech or writing ability can be overcome by adapting current remote user hardware and software devices for people with hearing/speech problems (text to speech, speech to text). Indeed the current development of haptics (the science of applying tactile sensation to human interaction with computers and computer driven devices) in the automotive industry may also provide useful offshoots for replacing a defective sense of sight or sound.

2.2   The development of new, possibly specialised technologies

2.2.1. New and specialised technologies for assisting the elderly will come from the development in materials, microsystems and ultra-precision engineering. Science and engineering will need to produce longer lasting artificial joints and possibly new artificial organs (for example, portable kidney machines) as well as other surgical, medical and healthcare devices. Equipment using sonar, laser beams and even global positioning satellites have been developed to aid partially sighted people to live independently, but there is scope for improvement. In addition, miniaturisation of electronics, wearable electronics and monitors, and biocompatible electronics that can be implanted will help frail elderly people to be monitored remotely. This will permit them to remain in their own homes and allow doctors to monitor how they are coping and to assess what the medical issues really are.

2.2.2 In addition to the development of technologies, there is a need to improve the training of designers and engineers to include incorporation of feedback from the potential user from both psychological and physical/medical viewpoints into product design. This must have a much greater role than is evident today.

3. Overarching considerations

3.1 How effectively is research co-ordinated in the public, private and charitable sectors (including internationally)?

3.1.1. Private and public research has been reasonably co-ordinated and the charitable sector has been closely involved in the human factors aspects. However the UK has not generally been good at cross-Research Council funding. There is also a concern that if we do not take action soon to co-ordinate our research, we could find ourselves missing out on a lucrative share in the fast growing market of the provision of the medical care solutions for the ageing population. This market has the potential to be extremely beneficial to the UK economy.

3.1.2. Collective collaboration between organisations having religious, ethical or philosophical connections often only starts from a common interest in a particular field. There is no automatic, nationwide coordination or research strategy to address issues - except in some rare and specific cases which are of such public interest, e.g. cloning, where collaboration is identified to address a high profile story.

3.2   Have the correct priorities been identified? Are there any gaps in research?

3.2.1. With respect to the financial impact of technological advances, further research is needed into the economic trade-offs between providing better independent care for older people through technology and the savings this can create in care home accommodation or hospitalisation.

3.2.2. It is noted that there is a lack of a national research strategy which underpins the specialist work undertaken in specific areas. The priorities may have been identified by the researchers in each field but it is doubtful whether true priorities of nationwide concern often apply to the overall research scenario. This need not be the case.

3.3   Is there sufficient research capability in the UK?

3.3.1. It may well be the case that there is not sufficient research capability at this moment for all of the topics of concern. The current health care system tends towards filling gaps, and responding to a crisis as it arises. Meanwhile the private sector has the luxury of dealing with issues where there is an identified need and budget available to address it with a solution.

3.4   Is the research being used to inform policy?

3.4.1. The research carried out in the UK seems to be by well-informed groups that have identified a need and are being funded by those organisations that have also identified the need, but there is a lack of a co-ordinated national policy.

3.4.2. We would like to see a move in policy towards founding a nationwide programme which promotes an automatic health review at 60. This review could provide the basis for regular monitoring - carried out both by healthcare professionals and by self assessment - throughout the rest of the person's life.

3.4.3. Changes in policy should also reflect the need for better use of the intellect of older people. The payback of better long-term health care would be that useful members of society could be saved from early onset of debilitating diseases and therefore keep in better health for professional activity beyond the age of sixty-five.

3.4.4. In the long term, the UK government should look to reforming policy outside that which currently directly connects with the scientific aspects of ageing. Implementing long term policy to discourage obesity and smoking; encouraging health self-awareness; and the provision of better access to primary care across the entire demographic spread of the population of the UK should ensure that the older generation of the future are better prepared for their extended life.

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