



Appendix 4

The Role of Assistive Technology in Alternative Models of Care for Older People

Dr. Donna Cowan and Dr. Alan Turner-Smith
Centre of Rehabilitation Engineering,
King's College London

INTRODUCTION TO ASSISTIVE TECHNOLOGY

This paper outlines Assistive Technology (AT) that is currently available to enable older people and carers to retain an independent lifestyle. Much of this technology is designed to aid activities within the home. In this context 'Home' includes sheltered housing but not hospital or residential care. We will discuss its application within context, and present possible future developments in the field. The report excludes technology used exclusively for diagnosis and palliative care, although some of the devices described do also have great value in these areas, for example in monitoring or warning about dangerous medical conditions.

1. Terminology

Assistive Technology: is an umbrella term for any device or system that allows an individual to perform a task they would otherwise be unable to do or increases the ease and safety with which the task can be performed. This report will focus on **devices** rather than systems. A number of terms have been coined to describe technology associated with the reversal or amelioration of the declining capacities of older people. These include:

Healthcare technology: a broad term encompassing all technologies used in health care.

Telemedicine: has traditionally referred to the application of medical practice by telematic means, but has recently been enlarged to include all telematic healthcare technology.

Gerontechnology: describes the whole gamut of Assistive Technologies for older people.



Care provider technology: Assistive Technology for the family or personal carer, who is often the forgotten key to care of older people, and the on-going professional service provider.

Independence and security technology: specifying particular relevant functional elements of Assistive Technology.

Rehabilitation Technology: refers to rehabilitation services, which might be more correctly understood as ‘habilitation’ services because they aim to bring people to their maximum well-being, regardless of their initial condition.

Wellness Technology: a term used to correct the negative connotations of ‘technology for disability’. It is particularly associated with technology for the prevention of deterioration, for example by encouraging physical exercise, enabling appropriate changes in lifestyle and changed roles in work, or allowing improved social contacts.

A technical classification of AT has been given in ISO 9999 (EN29999). An alternative classification given by the World Health Organisation (ICIDH, 1997; ICIDH-2, 1998) places more emphasis on the social aspects of disability. A helpful classification in the context of understanding the role of AT has been given in the HEART report (Azevedo *et al.*, 1994) reproduced on the right. Devices that may be of particular use to older people are highlighted. AT that is currently or soon to be available is described in the section on ‘Current and coming Assistive Technology’.

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| <p>Communication</p> <ul style="list-style-type: none"> Interpersonal Computer Access <p>Telecommunications</p> <ul style="list-style-type: none"> Multimedia User Interfaces <p>Environmental Controls (Seating and positioning)</p> |
| <p>Mobility</p> <ul style="list-style-type: none"> Manual Mobility Aids <p>Powered Mobility Aids</p> <ul style="list-style-type: none"> Private Transportation Public Transportation Motor Function Seating and Positioning |
| <p>Manipulation</p> <ul style="list-style-type: none"> Recreational/Sports Devices Robotics <p>Environment Control/Adaptation of Houses</p> <p>ADL Devices</p> <ul style="list-style-type: none"> Motor function |
| <p>Orientation</p> <p>Orientation and Navigation Systems</p> <ul style="list-style-type: none"> Telecommunications (e.g. video telephones) Robotics |
| <p>Cognition</p> <ul style="list-style-type: none"> Time aids Planning aids |

2. The aims of Assistive Technology

Each of the terms coined above was chosen to reflect or to correct a particular approach to the issues of wellbeing of one group within the community. In this report we will use the term Assistive Technology (AT) in an entirely neutral manner and will comment on the significance of its application as necessary. The aims of AT are to allow older people to maintain their autonomy and dignity, to enable pursuit of self-fulfilment, to allow an independent life and valued membership of society.

The implication of these aims is that a ‘medical model’ is inadequate to describe the needs for AT. Appropriate AT will be chosen with regard to differences of environment, personality and culture. These requirements will change both with age and with changing conditions and expectations of society. These moving goal posts imply that the provision of AT must be timely and appropriate if it is to be



effective and its use regularly reviewed to reflect these changes. In medical terms, successful AT requires adequate service provision that allows early intervention, and thorough, holistic assessment as well as delivery of devices. Support services must however be of paramount importance as a need or requirement is rarely fulfilled by the provision of a single piece of equipment.

The social model of disability recognises that people may have difficulty in defining themselves as disabled or in need of special equipment, so they may not look for an aid or take up a service offered with the best of intentions. The aim of assistive technology design is therefore to create a device that is attractive to own and adds ability without removing status. Such a device will often be happily paid for in preference to an equivalent, statutorily provided device that meets medical need but attracts social stigma.

Assistive Technology can be costly and many of the items mentioned below are available through statutory services. Prospective users however should be aware that the range of devices available through these sources could vary greatly from one local service to another. Eligibility criteria can also vary as can the contribution requirement from the user.

The issue of design and acceptance or rejection of AT will be addressed in the section 'Assistive Technology Issues'.

CURRENT AND COMING ASSISTIVE TECHNOLOGY

In this section we review some of the AT devices currently available, those that are expected to arrive on the market within the next few years and consider the medium and long-term future of AT.

1. Mobility aids

Reduced mobility is one of the major disablements that often accompany old age. The growth in prosthetic joint replacement in the lower limb, which is costly to the individual as well as society, and its application to younger age groups testifies to the importance of pain-free mobility. Orthotic support is a form of AT that is constantly improving thanks to new stronger, lighter materials (e.g. carbon fibre), improved fabrication techniques and innovative design. Knee and ankle orthoses are generally custom-made, however, and therefore tend to be expensive.

Some items of AT are accepted readily by most users as they serve both able and disabled users. Reclining chairs and adjustable beds are examples that can restore near-normal function when close supervision would otherwise be necessary.

When self-supported mobility becomes difficult walking aids can assist. These range from simple sticks, crutches, and walking frames through to rollators with various accessories. The popularity of these devices sometimes rests on their double functionality, as when shopping baskets are attached to a rollator.

Wheelchairs are provided by an extensive nation-wide service to both occasional and full-time users, in manually powered and electrically powered versions, depending on need. Recent legislation in the UK has provided for indoor-outdoor



powered chairs and also enabled users to add to the basic prescription by paying for customisation or special designs through a voucher scheme. The choice of equipment available depends on the arrangements that the local wheelchair service has made with their healthcare purchaser, manufacturers and local maintenance contractors.

Stair lifts or through-floor lifts are major items of AT that can restore access to a previously uninhabitable home. These are designed to fit one premises and so, like much house automation, are much cheaper if installed during construction.

2. Aids to Daily Living (ADL)

There is a wide range of equipment available for people who find operating or handling everyday items more difficult. These items are used in a wide range of daily activities such as personal care, housework, and leisure activities. Many aids to daily living are available through social services however, as stated above, the range and eligibility criteria are highly variable.

Some of these items (e.g. adapted cutlery, tap adapters, dressing aids) have over the past five years become easier to purchase and are now sold through a few well known high street retailers. Specialist stores who sell only these items have also become established around the country. Mail order is often available from them to encourage use.

Costs for ADL items can be as little as a few pounds for items such as hairbrushes or adapted taps to several thousand pounds for items such as special shower and toilet facilities.

Information about these devices is available from a number of sources, some of which are listed under 'Bibliography'. However, like most AT, the sources refer to 'disability' rather than 'changing need'.

3. Environmental control systems (ECS)

Environmental Control Systems are devices that allow the user to retain control of their environment within the home despite changing physical abilities. In general they allow control of any household item which can be controlled by using a remote control. The most frequently encountered items with this type of interface are audio-visual equipment i.e. televisions, stereo equipment and video recorders. Other devices can however be adapted to function from a infra-red input such as heating controls curtain openers, door locks and openers, intercoms, telephones, electrical power points and a host of other items.

ECS are currently available through the NHS to people with severe and complex physical disabilities (BSRM, 1994). The provision process varies from area to area however it generally involves a referral from one of a number of people (e.g. users, carers, consultants, GPs, social services workers) followed by an assessment. The assessor decides whether there is need for the system and which system would best suit the user depending on the user's abilities and requirements in the home.

An ECS may be upgraded in that a simple system controlling only a few items may at first be prescribed until the user gains confidence with their system and then extra items may be added as realisation of the potential of the systems grows.



The systems usually consist of a control pad that can vary in shape, size and format depending on the user's abilities and are generally operated using a single switch. The options available appear as a list to the user e.g. light, fan, TV, radio, telephone and a scanning method is employed to offer the range of options to the user.

Infra-red (or radio frequency) operated power modules are plugged into standard electrical sockets in the home and the device to be controlled by the user (e.g. a fan or radio) is then plugged into these modules. The control pad stores the codes to operate each of the devices to be operated in the same way that a standard remote control can store all the codes required to operate a video recorder. Some systems use radio frequency signals instead of infra red, in this way line of sight is not required between the transmitter and the receiver.

Currently only three manufacturers hold contracts with the NHS to supply these systems, and therefore the range available through this service is limited (Medical Devices Agency (MDA), 1995). A wider range is available commercially and may be purchased privately.

As already stated, this service is intended only for people with severe disabilities, however the concept of operation that an ECS offers could usefully be employed by someone with a less severe disability. For example the user may have difficulty operating a standard remote control. A large pad remote control may ease the operation of individual items or an 'all in one' remote suggested to replace the three or four control pads operating separate devices in the home. There are a variety of these available from high street stores. The most common simply have stored within them thousands of manufacturer's codes for different devices. The appropriate codes can be selected by following simple start-up procedures. Some remote controllers are able to 'learn' new codes. Device control codes can be input therefore making a single remote capable of operating a TV, video, lighting system and curtain operator.

Many DIY stores stock items such as curtain openers that can be operated by remote controls which are easily installed.

Lighting switches can sometimes be a problem for those with reduced finger power or dexterity. Again DIY stores stock infra-red controlled switches, roller or touch sensitive pad switches, all of which can be used to operate main overhead lighting. Another component of an ECS which is widely used is a remote controlled door release and intercom system. This allows those who are immobile to control access to their home. By including a closed circuit television the user can see who is at the door before opening it.

Costs for the above items can range from £20 for a multifunction remote control to several thousand pounds for an environmental control system with speech output.

4. Communication

This can cover a wide range of equipment, from relatively common hearing aids to high-tech computer-based speech synthesised text to speech output systems. One problem commonly associated with the more sophisticated systems is that they can be bulky and so are predominantly aimed at non-ambulant users.



Communication aids centres are located around the country to provide assessment and advice. Some provide follow-up sessions or training courses on the use of aids for therapists etc, others keep strictly to the prescription and assessment stage of the process. The cost of the assessment is not inconsiderable in some cases and therefore referral is through a professional, usually speech and language therapist or GP.

Having been assessed, the provision of the prescribed item may depend on the availability of charitable funding or the user's ability to pay for their own device as there is little official funding for communication aids. As with all types of equipment, support in the use and maintenance of the device is vital and because of the lack of funding this is often a reason for the disuse of devices.

Recent technical advances have led to an improvement in communication systems in general which could potentially reduce the isolation encountered by older people or indeed anyone who may have reduced mobility. Most of these possibilities are due to the development of the Internet. An example of this is in the use of video conferencing. To date this has been an expensive tool available only for commercial use, but recently software has become available to enable cheap video links via the Internet (for about £1000). It has been suggested as an effective way of forming self help groups for older people and carers alike (Magnusson *et al.*, 1998).

The use of computers to provide entertainment already combats loneliness. In the section 'The Future' we consider this further. Home shopping via cable TV and the Internet is already available, bringing back the old concept of delivery to the door. The Internet is also proving to be a useful means to enable continued participation in cultural life. People can share artistic, education and the creative arts: pictures, video, sound, electronic publishing with other homebound friends or able-bodied people (Klöve *et al.*, 1998).

5. Security: Telephones, Telephone/Alarms, and Alarms

Telephones, once considered a luxury are now seen to be an invaluable tool for all. They allow the less mobile to keep in contact with relatives and friends, enable business transactions (using services such as telephone banking) and allow people who may otherwise be restricted, to initiate social contact. Like all AT, however, the provision of a single piece of equipment should not be viewed as a total solution to the problem of communication but rather, in the case of telephone equipment, as an addition to face to face communication to prevent increased isolation (Cullen, 1992).

A wide range of products are available to users who have disabilities (both sensory and physical), and those who are older requiring adaptation to existing systems (British Telecommunications, 1998). As with many other forms of assistive technology, available services and adaptations can often be overlooked by older people who may be experiencing problems using their telephone effectively and yet do not consider themselves to be 'disabled'. They may require a simple alteration such as a large button pad to compensate for decreased dexterity when dialling numbers or reduced visual acuity. A number of 'options' are available in an effort by the industry to provide service and access for all including various handsets and adaptations, priority services and alternative services for people who have sensory impairments.



For those with a visual impairment, enlarged number pads and labels for handsets can be used. For those with a hearing impairment, alternatives such as loudspeakers and visual and vibrating alarms are available. Acoustic amplification is available and inductive coupling units (magnetic amplification) for users who have hearing aids. Where amplification is not the answer a number of alternatives exist. Text output devices such as message pagers or fax machines may be a solution, alternatively, more specialised equipment such as textphones. These usually consist of a standard QWERTY keyboard and a screen. The user types what they have to say and receives what the recipient types at the other end and so a written conversation takes place between users with compatible equipment. The problem existing with this is compatibility allowing world-wide communication (COST 219 Final Report, 1992). Text phone users can communicate with users of standard telephones via the TypeTalk service. This is a relay service currently operated by the RNID (Royal National Institute for Deaf People) in the UK.

Videophones consist of a standard phone with a video link. Although this technology has been available since the early 1960s, videophones have had little impact on every day life. This has been due to a number of factors including bulky equipment and high costs, however, the introduction of ISDN (Integrated Systems Digital Network) is likely to have a significant impact on this technology and aid its further introduction. Some European countries already have already introduced an internal videotelephony service (Cullen, 1992)

For users with mobility impairments, solutions such as extension sockets and cords to allow the telephone to be moved throughout the home, and cordless or mobile phones enable users to keep the phone near at all times.

For those with dexterity impairments large number pads are available as well as phones which allow 'hands free' operation. These have in-built microphones and loudspeakers allowing two way conversation without the need to keep hold of the receiver. Similar telephones are used as part of ECS described above.

For users with impaired or without speech, telephones are available which output recorded messages by pressing buttons on a keypad. Others allow users with communication aids that have speech synthesised output, e.g. a Liberator¹ or Cameleon², to make calls unaided using a single switch.

An advisory committee on telecommunications for disabled and elderly people (DIEL) exists which provides information and advice to Oftel. Although they do not provide a comprehensive information service to the public they do provide information packs on what telecommunication products are available for older and disabled people.

Telephones are often considered for use as an alarm as it enables the user to summon help in an emergency. Their use however is limited if the user falls or needs assistance when out of reach of a telephone or indeed if the user cannot gain a reply from their call for help (Thornton and Mountain, 1992). A development from the stand-alone telephone has been that of community alarm systems/services (Riseborough, 1997)



A community alarm system/service has three components:

1. Means of calling for help

This is usually a small portable trigger (usually radio frequency) which is carried at all times, usually worn around the neck as a pendant. When activated an alarm unit is triggered (situated by the phone). This unit is programmed to contact a central control point using the standard telephone network.

In most systems an amplified speech link is opened between the caller and the operator.

2. The control centre operator interpreting the call and initiating action

Operators at the control centre talk through the problem with the user and if necessary initiate action by arranging for an appropriate 'visitor' to call.

The call receiving equipment is generally linked to a database holding information about the user

3. Respondents

If necessary designated people then visit the user and assess the situation/offer help. The people doing this vary depending on the service. Sometimes they are employed by the answering service or else designated by the service user e.g. family members, neighbours. The action taken by the visitor also varies i.e. may give physical aid or simply act as a key holder to enable others to enter the user's premises.

A wide range of alarms is available commercially for users to buy from a variety of sources. These range from personal alarms which emit high volume sound when activated (costs from £10) to mobile pagers which directly contact another person (costs from £200). Home based alarm systems equipment such as that described above can be bought for on average £250. Extra costs may include the installation of a phone line.

Alarms are also available that are activated if the user falls, a particular hazard for older people. A positional sensor determines the angle of the alarm and hence user relative to the horizontal. Activation occurs if it is less than 20 degrees, or if the user is prone or supine for more than a specified time period (information from the DLF database, 1998).

'Wander' alarms are also available. These devices can be useful by reducing the anxiety associated with wandering for a wide range of carers e.g. people caring for those with learning disabilities, with some forms of dementia and for parents with young children. In general these alarms take the form of pendants or clip-on sensors, which emit a radio frequency signal. If a detector within a specified distance does not receive the signal either continuously or at predetermined intervals, the alarm is activated. Costs for these types of alarms vary from £25 to £6K and upwards for a residential installation. Alternatively, a mat with implanted sensors across a doorway can be used to alert carers if someone leaves a specified area (costs up to £230).



6. Cognition

It is sometimes thought that people with cognitive impairments cannot manage new technology, which could account for the small range of products developed for this group. However, AT is becoming available for and being used by people with learning disabilities (e.g. reminder systems, special clocks, pictogram and diary systems to help them to plan their own day³) demonstrating that this is not the case. Although still a rather small area the equipment available could be used for people who become confused or suffer from a cognitive impairment. Future developments of computer and software technology will increasingly allow cognitive support to become a natural and life-enhancing reality.

7. Integration: Smart Houses

‘Smart Housing’ is a term used to describe the electronic and computer-controlled integration of many of the devices within the home. (The term ‘domotics’ is used to mean domicile/domestic technology). Smart Housing for older and disabled people has and is being tested at a number of sites around Europe (Elger and Furugren, 1998; Bonner, 1998). Validation includes cost-benefit analysis of a wide mixture of technology and service organisation (Ng-A-Tham, 1998).

It allows the integration of environmental controls for effective control of a building, either by deliberate control or automatically. This includes door and window openers, curtains and blinds, heating, lighting, security devices including motion sensors and video surveillance, telephone and communication, water taps, cooker, bed warming. Monitoring of activities can even be extended to daily health checks, for example an instrumented toilet has been developed to measure heart rate, temperature, and nutrition (Tamura *et al.*, 1998).

Although the basic technology for domotics has been available for many years, the software systems and network standards have not yet converged to the point where systems can be sold in large numbers to reduce cost. Low-cost systems such wireless and radio control are available but currently not reliable enough for safety-critical AT applications.

Builders do not want to commit to any new design so economies of scale are not available. Consequently installation is strictly needs led. The future domestic market, however, is likely to be led by entertainment rather than necessity.

If smart house technology is installed as an AT solution, someone must be technically responsible for the **whole** system of equipment otherwise individual suppliers will argue when system breaks down. Statutory bodies providing AT are naturally reluctant to take on this new and costly commitment.

Although smart housing has been promised for many years, current international discussions are at the stage that a standard is likely to emerge before the millennium. Once the smart house concept has been adopted, the smart neighbourhood is not far away.



ASSISTIVE TECHNOLOGY ISSUES

1. Awareness and Accessibility/Availability

It has long been acknowledged that the uptake of assistive technology is dependent on a number of factors, one of these being the availability of current and easily-accessible information about availability, cost, assessment procedures and funding sources (Mandelstam, 1990). A number of sources are available (see the Bibliography), however whether they will be used or not depends on the users perception of themselves. For example, a large number of potential users of ‘aids to daily living’ would be older people who require some support and assistance in everyday life yet are unlikely to define themselves as disabled. A second group would be older people with disabilities (having had a disability from birth or acquired later in life). The first group may be hesitant or simply not consider going to a resource centre for information about what they would consider ‘aids for people with disabilities’ or referring to an organisation such as the Disabled Living Foundation for information. However many of the information sources that carry relevant material about these aids are offshoots from charities or organisations associated with a particular disability, condition or illness.

To ensure relevant design and uptake of technology, older people have to be given power to influence developments for themselves. This is being addressed by centres such Centre of Applied Gerontology at the University of Birmingham who provide a consultancy service to industry. In addition, the spending power of older people will increasing apply pressure to the design process.

2. Attraction and Affordability – Economics

In deciding allocation of resources for new technology, do we use the judgement of society, of carers, or of older people? It is generally recognised that in the context of increasing possibilities for medical care and an ageing population, society alone cannot and should not be the sole funder of AT. Without waste of resources, how can investment on care in the home be encouraged? Residential care is already expensive with respect to AT in the home, so further incentives such tax concessions will have little effect. It can also be difficult to define AT. The most efficient way of increasing resources for home care may be by raising awareness of the possibilities and attraction of AT through information spreading and teaching by example. Inclusion of AT in TV soaps can have a major impact on the awareness and desirability of AT.

Broadcasting a purely technical model of AT disability may also pose a threat, encouraging technical push where disability applications can be just a decoration. Healthcare services are all too aware that once a technology (tool of support) has been adopted, it is difficult to dispose of!

Ability to live at home is an issue of quality of life. This is not best measured in an entirely healthcare or medical model of an individual, but in some more holistic model that includes empowerment of older persons who are suffering a loss of influence, status (importance to others) and sense of self worth. The model should also include the wellbeing of their family or nuclear social group, and the wealth (in the highest and broadest sense) of their society. As a consequence, holistic funding becomes essential. Funding through one channel (e.g. health or social services) creates distortions due to budget competition, or



inefficiency due to duplications, holes in support, and incompatible technical or social solutions.

3. Assessment and Acquisition

It is always wise to get advice on a purchase from an independent or professional source. The contact information list (section on ‘Some National and International Services’) contains a number of sources, however the user’s requirements and condition must be considered before recommending one rather than another. For example, someone who simply requires a jar opener due to reduced strength has a different need to someone with a deteriorating condition requiring help with mobility. In the latter case a GP might refer a requirement for a wheelchair first to the local wheelchair service to have needs properly assessed whereas the former could simply buy a jar opener from a local store. Appropriate routes to information have to be established in order for the user to get the fastest and most appropriate response. Information about Assistive Technology has traditionally been aimed at the professional rather than the user (e.g. Hamilton Index). It is this lack of user awareness which may account for the engineered rather than the designed appearance of some products (Mandelstam, 1996). This approach is being challenged and documents such as the Department of Health booklet (1996) attempts to give a user details of how to go about getting specialist equipment. As well as this information provided by charities and support groups often provide factsheets about AT and where to go for further advice. The Contact Information section contains a selection of organisations that provide this type of service.

Many of the services listed have websites that are freely accessible to those with a computer and internet connection (see Bibliography). However, as most older people are still without this form of communication, fact sheets and telephone helplines are offered by many of the organisations.

4. Acceptance, Use and Rejection

It is well recognised that assistive technology often remains unused (Korpela *et al.*, 1993, Sonn *et al.*, 1996). This may be because the technology was incorrectly prescribed or imposes too great a burden in use. Often, however, it an important reason for rejection is the stigma attached to an assistive product. Services provide technology to meet a ‘need’, but users (and their carers) will most readily use technology that is desirable because it enhances their social status as well enabling them to do things or making them feel better. It is because design for older and disabled people at home has to be based on want, not an assumption of need, that much research in AT is currently aimed at exploring acceptance.

‘I am ashamed of the (adapted) bathroom, when anybody goes, I feel like, oh it’s so terrible, you know . . . You see, I’m not a normal person!’

(Lebbon and Boess, 1998)

The importance of social awareness is hard to over-estimate. To this end the MediaAge news service was launched in 1998 at European Social Policy Forum in Brussels to inform journalists, non-governmental organisations and older people.

Legislation can also help. The alteration of fashion and social perception has been a major benefit of the Americans with Disability Act (1990).



5. Europeanisation and Standardisation

According to the White Book of the European Commission (COMM, 1994) the intention is to promote the integration of people with disabilities. The Commission will also derive a suitable instrument to confirm and support the UN's Standard Rules on the equalisation of opportunities for persons with disabilities. One of the rules concerns support services.

'States should ensure the development and supply of support services, including assistive devices for persons with disabilities, to assist them to increase their level of independence in their daily living and to exercise their rights.'

Thus the role of AT in support of older people is well recognised.

The market in assistive technology currently suffers from being small and fragmented, which results in generally high prices and under-developed design. Europe, however, is the largest potential market for AT products in the industrialised world. In 1995 about 26 million potential consumers of AT products can be expected. Between 1995 and 2020 the estimated number of people, who are potential users of AT will increase more than 25% according to Carr *et al.*, (1993). A single European market in assistive technology will have a great economic impact, from which industry, administration and the users will benefit. A single European market will also improve the possibilities for export outside the European Union. This enlarged market will benefit users by reducing costs and improving design.

A larger market is attractive for many reasons, but the differences between national service delivery systems, and national social and psychological preferences renders progress to a single market difficult. People in different countries have different preferences to input mechanisms. For example, PAM-AID is a walking aid for frail and visually impaired people, the development of which involved user requirement studies in UK Ireland and Sweden (O'Neill *et al.*, 1998). The study showed that users in the UK preferred finger and thumb operated switches for input whereas in Sweden people prefer using a finger alone. So items produced for a mass European market will still require modification for different preferences.

When technical issues alone are paramount, standardisation can be a major assistance to market development. As mentioned in Section 2.5 above, a number of text telephone systems are available throughout Europe but incompatibilities inhibit communication between them. Agreements are being sort in most technical spheres. For example a new EU standardisation work is starting in Sept/Oct 1998 for accessibility to IT following Medical Devices Directive 93/42/EEG.

The Medical Devices Directive on the design and manufacture of medical devices has important implications for AT. Most AT devices are designated 'class I', i.e. presenting low risk. Since June 1998 the manufacturers of these devices have had the responsibility of registering with the appropriate authority in their member country and ensuring that devices used in healthcare meet certain design and manufacturing requirements. Some fear that this harmonisation process may cause the rate of innovation in the market to decrease. However the quality of



products will be enhanced and they will be able to be marketed across national boundaries in Europe.

6. Education and training

It is sadly true that not all professionals advising on AT are adequately trained or knowledgeable about what AT can do. One reason for this is that up-to-date specialised education and training has largely been unavailable, except in Sweden and the UK (HEART Study Line E, 1995). Efforts are currently underway to stimulate education across Europe to utilise the total competence within Europe, in order to lead to a higher quality and uniformity of care within service provision.

Carers and users also require information and training. Some carers develop their skills over a long time as an older relative gradually becomes more dependent, for example. Others are thrown into the job, for example when their partner becomes suddenly disabled following a stroke. The latter group in particular needs training and network in a hurry. In this respect interactive video links in the home can provide welcome information, training and a network to others with similar problems or solutions to share (ACTION).

Even before a product is made available, those involved in the design process need training. It is desirable to involve older people and carers in the formation of engineers and designers as well as consulting them in the design process itself (see, for example, Poulson *et al.*, 1996). They are, after all, the experts on everyday life. The best designs emerge from an informed network of designer, consumer, manufacturer and provider.

Take-up of AT depends critically on knowledge of its availability, so information technology and the education of professionals, older people, and carers is another essential lubricant to appropriate adoption of AT.

Beyond those immediately involved we have already mentioned the stigma associated with some AT. This is where social education is required – a task for schools, charities, and the media as well as AT professionals.

THE FUTURE

1. Discussion

We cannot predict the future, but there are certain trends that indicate likely technical possibilities. Using these we present here a few ideas that may stimulate thinking. A forecast to 10-20 years is generally considered 'long term' and highly unreliable, but we do well to remember that to foresee the possibilities for the next generation of older people we need to think 30 years ahead. Such long-term prediction is made even more difficult by the fact that the needs of older people, the capabilities of their carers, and the shape of their society will also change. For example, are the expectations and fitness of today's 40-year-olds compatible with the heavy caring role that demographics suggests they may be called on to undertake in 20 years, let alone their own requirements as older people in 40 or 50 years? Will advances in medicine change the nature of the demand for Assistive Technology?



As a background to technological change it is worth noting that computing power has been roughly doubling every year for the last 15 years. In 20 years it is reasonable to expect we could have 10 times the power of today's fastest multimedia personal computer available in a package the size of a credit card for the cost of a newspaper. The development of mechanical technology is not so rapid and has been aided in recent years chiefly by the use of information technology in design or by the use of electronic control to overcome limits of mechanical tolerances.

SMART house technology has the potential for immediate application. Once a common standard emerges it is possible to see this becoming a standard for new buildings. Building design for all, i.e. designing a building to suit all ages of people, is a new concept that is likely only to be adopted on a significant scale in the short term through building regulations. This is because builders get their return from the first buyer, not the whole spectrum of buyers who might occupy the property through the years. Mixed housing stock suitable for creating communities of all ages is a possible intermediate solution.

In the process of housing design, virtual reality is a new tool that will increasingly enable architects and AT designers to build more age-friendly housing. It will also enable older people to assess their ability to live independently.

Orientation and navigation within buildings will be assisted by intelligent signage or signage aids (e.g. signs that show the way to the toilet when asked, or even when they detected that it might be necessary based on a previous pattern of movement or physiological condition).

In all future scenarios it is important to remember that AT is not just to enable an older person to live alone, but to maintain autonomy when living with his or her family or carer.

Take-up of technology by older people is not related solely to chronological age, however it is true that familiarity with a technology makes it easier to learn. With this in mind we can expect future older people to be as comfortable with computer controls as the present generation with telephones. We need to think of the technology being used extensively by the current generation to think of the implications for next generation of older people.

We are moving into an information age where although we are developing tools to order information (e.g. hypertext) we are also being swamped by more information than even, thanks to increasing connectivity (e.g. Internet). In the future we can expect it to be easy to find detailed information about AT devices, to find how to use them and to locate and interact with a human network that is experienced in using.

It should always be remembered that the opportunities and equalities created by technology, where physical strength or memory does not matter so much, also creates barriers. For example new interfaces that fully-abled people can enjoy may be unusable by older people with cognitive problems, vision, hearing, manipulation or other infirmity. We have seen the dangers of the 'windowing' systems used now for computer displays that might have created insuperable



problems for partially sighted people. Fortunately these issues are being actively addressed at the core of the operating systems thanks to active lobbying and technical assistance from disabled groups worldwide.

The evolution of computer games and interactive television will provide a stimulating and ultimately very worthwhile form of entertainment. Further, in the future it is possible to imagine a world in which it becomes rather difficult to defining 'reality'. It will certainly not confine its inhabitants to the limitations of a human body. We may then wonder what the importance of mobility will be. We can think of digital shared memory albums: provokers that will stimulate memories with sounds and smells, texture and shape as well as vision. A personal virtual reality diary will enable older people to re-live and share their experiences more effectively with each other, with their grandchildren, or whoever.

Although we do not need to move as much as we do now, it seems that physical meeting of human beings is still of paramount importance. We are social animals, so mobility aids may still be important in the future. But mobility is limited by the imperatives of physics: it does take a significant strength and energy to move people from place to place. At the same time, encouraging mobility will certainly still be important for our physical wellbeing. Technology may be used to encourage a healthy lifestyle rather than compensate for the results of an unhealthy one.

2. European Research projects in the field

TIDE: *Telematics for Disabled and Elderly People* is an applied research programme under TAP, the Telematics Application Programme of the European Commission Directorate-General XIII. TIDE aims to develop applications that provide support for independent living, autonomy and social integration opportunities and to open up society to older people and individuals with disabilities. Focusing on assistive technologies, the sector is developing systems that improve mobility and interpersonal communications, and which shape the immediate environment to suit individuals' needs. From Braille or acoustics displays for personal computers, to robot arms for wheelchairs, informatics or communications technologies can enhance quality of life and tailor state-of-the-art technology to the specific needs of the user.

ACTION '*Assisting Carers using Telematics Intervention to meet Older persons Needs*' project aims to determine needs of informal carers and then to develop an expert system which will give access to practical assistance in developing competency i.e. safe lifting etc. It will define the choice and process of eliciting respite care help, financial resource availability and improvement of coping skills. The project will show that through a combination of familiar technologies e.g. TV remote control units and use of additional i.e. video reception and transmission, fast computer processors and access to interactive communication – on line effective care information communication can become a reality for formal and informal carers.

CERTAIN *Cost effective rehab tech through appropriate indicators* plans to develop methodology of evaluation of cost effectiveness and cost utility of rehab technologies and will then validate the methodology. It aims to provide a robust method to prove cost effectiveness of AT.



COST 219 bis *European co-operation in the field of Scientific and Technical research* is a framework for scientific and technical co-operation in Europe. The main aspect is a co-ordination of the national research on an European level. COST Actions consist of basic and pre-competitive research as well as activities of public utility. From an initial 7 Actions in the beginning COST has grown to 123 Actions in February 1996. At the moment the COST co-operation consists of 25 member countries: The 15 EU Member States, Iceland, Norway, Switzerland, The Czech republic, Slovakia, Hungary, Poland, Turkey, Slovenia, Croatia and The European Commission.

DAILY aims to develop an interactive CD-ROM that supplies information about assistive devices to the elderly with minor mobility problems who want to remain independent. Provides knowledge about types of technology and how to use and furnish their home with them – enabling individuals to take the initiative in defining his or her own needs. Users can choose among different subjects and problems they want to solve.

EUSTAT: – *Empowering users through Assistive Technology* – aims to develop a training model set of curricula and basic educational material for the education of end users of assistive technology. This will enable end users to make informed choices about AT and improve skill of peer counsellors and professionals.

FACILE aims to produce the definition, the realisation and the experimental application of support tools for the design and management of living spaces provided with automated telematics systems and external services, targeted to elderly and disabled (end-users).

FACILE will develop a catalogue of home environment systems concerning home automation systems and available products. Also a design guide for the modification of the home environment.

HOME aims to produce an intelligent multimodal and multimedia user interface providing a new dimension of natural man machine communication able to remotely control and even tele-operate (via mobile phone) all home appliances, usable by the vast majority of elderly and disabled users.

PAM-AID is a mobility aid for partially-sighted people which will enable users to improve their personal autonomy and remove the need for complete dependence on carers.

SAFE 21. Care and security for elderly people at home in Europe is fragmented. Social alarm systems only provide an emergency response to a call initiated manually by the user. SAFE 21 aims to take social alarms in Europe into the 21st century, using the existing infrastructure to deliver much broader assistive technology and extending availability to users who are currently excluded.

TELEMATE: Telematic Multidisciplinary Assistive Technology Education. This programme is developing a framework for the design, conduct and continued maintenance of modular courses in Assistive Technology for people from all disciplines involved with its across Europe.



Footnotes

- 1 Liberator Ltd, Whitegates, Swinstead, Grantham, Lincolnshire NG33 4PA.
- 2 Cameleon: Cambridge Adaptive Communication, The Mount, Toft, Cambridge CB3 7RL
- 3 <http://www.handitek.se/html/eng/WATCH.HTM#download>

References

- ACTION: EC DGXIII TAP project DE 3001: *Assisting Carers using Telematics Interventions to meet Older persons Needs*.
<http://www2.echo.lu/telematics/disabl/action.html>
- Axtell, L. A. and Yasuda, Y. L. (1993) *Assistive Devices and home modifications in geriatric medicine*. Geriatric Rehabilitation 9 (4), 803-821.
- Azevedo, L., Feria, H., Nunes da Ponte, M., Wann, J. E. and Recellado, J. G. Z. (1994) Heart Report: Line E – Rehabilitation Technology Training: E3.2 European Curricula in Rehabilitation Technology Training, European Commission: Brussels.
- Bonner, S. (1998) Assistive Interactive Dwelling House. In *Improving the Quality of Life for the European Citizen*, Placencia Porrero, I. and Ballabio, E. (eds.). IOS Press, 396-400: Amsterdam.
- British Telecommunications (1998) *The BT Guide for Disabled People*, British Telecommunications PLC: London.
- BSRM (1994) *Prescription for Independence*. British Society for Rehabilitation Medicine: London.
- Carr, S., Carruthers, A., Humphreys, J. and Sandhu (1993) *The Market for R.T. in Europe: a Demographic Study of Need* in (Eds.: Ballabio, Placencia-Porrero, I., Puig de la Bellacasa, R.). *Rehabilitation Technology, Strategies for the European Union*, Proc. 1st TIDE Congress, April 6-7 1993, IOS Press: Brussels, Amsterdam.
- COMM (1994) The European Commission COM(94) 333, July 27, 1994.
- COST Action 219 (1992) *Final Report – Future telecommunication and teletinformatcs facilities for disabled people and elderly*. <http://www.stakes.fi/cost219/COSA130.HTML>
- Cullen, K. (1992) *Technology and the elderly. The role of technology in the prolonging the independence of the elderly in the community context – FAST Report R1992*. The Commission of the European Communities: Brussels.
- DAILY: EC DGXIII TAP project DE 3207: *Make Daily Life Easier*
<http://www2.echo.lu/telematics/disabl/daily.html>
- Dept of Health (1996) *A Practical Guide for Disabled People – where to find information, services and equipment*. Dept. of Health: London.



Elger, G. and Furugren, B. (1998) 'SmartBo' – An ICT and computer-based demonstration home for disabled people. In *Improving the Quality of Life for the European Citizen*, Placencia Porrero, I. and Ballabio, E. (eds.). IOS Press, 396-400: Amsterdam.

EUSTAT: EC DGXIII TAP project DE 3402 *Empowering Users Through Assistive Technology*. <http://www2.echo.lu/telematics/disabl/eustat.html>

FACILE: EC DGXIII TAP project DE 3207. *Support tools for housing design and management, integrated with telematics systems and services*.
<http://www2.echo.lu/telematics/disabl/facile.html>

HEART Study: Ohlin P, Fagerberg G and Lagerwall T (1995) *Technology for Assisting Disabled and Older People in Europe The HEART Study*. TIDE 1995.

Home: EC DGXIII TAP project DE 3003. *Home applications optimum multimedia/multimodal system for environment control*.
<http://www2.echo.lu/telematics/disabl/homep.html>

ICIDH (1997) *International Classification of Impairments, Activities and Participation: A Manual of Dimensions of Disablement and Handicaps*. World Health Organization

ICIDH-2 (1998) *International Classification of Impairments, Activities and Participation: A Manual of Dimensions of Disablement and Functioning*.
<http://www.who.ch/msa/mnh/ems/icidh/index.htm> or just <http://www.who.ch/>

Klöve, L., Lundman, M., and Oderstedt, I. (1998) *Culture for Everyone – in the footsteps of Frida Kahlo*. In *Improving the Quality of Life for the European Citizen*, Placencia Porrero, I. and Ballabio, E. (eds.). IOS Press, 164-167: Amsterdam.

Korpela, R., Seppanen, R. and Koivikko, M. (1993) *Rehabilitation Service Evaluation: A follow up of the extent of use of technical aids for disabled children* *Disab and Rehab* 15 143-150.

Lebbon, C. and Boess, S. (1998) *Wellbathing*. In *Improving the Quality of Life for the European Citizen*, Placencia Porrero, I. and Ballabio, E. (eds.). IOS Press, 192-197: Amsterdam.

Magnusson, L., Berthold, H., Brito, L., Chambers, M., Emery, D., and Daly, T. (1998) *ACTION – Assisting Carers using Telematics Interventions to meet Older persons Needs*. In *Improving the Quality of Life for the European Citizen*, Placencia Porrero, I. and Ballabio, E. (eds.). IOS Press, 173-178: Amsterdam.

Mandelstam, M. (1990), *How to get equipment for disability*. Disabled Living Foundation: London

Medical Devices Agency (1995) *Environmental control systems. Disability Equipment Assessment A14*. HMSO: Norwich.

Ng-A-Tham, S. (1998) *Equality service, accessible for all citizens, in particular Elderly and Disabled*. In *Improving the Quality of Life for the European Citizen*, Placencia Porrero, I. and Ballabio, E. (eds.). IOS Press, 189-191: Amsterdam.



O'Neill, A. M., Petrie, H., Lacey, G., Katevas, N., Karlson, M. A., Engelbrektsson, P., Gallagher, B., Hunter, H., Zoldan, D. (1998) In *Improving the Quality of Life for the European Citizen*, Placencia Porrero, I. and Ballabio, E. (eds). IOS Press, 292-295: Amsterdam.

PAM-AID: EC DGXIII TAP project DE 210: *Personal adaptive mobility aid for the frail and elderly visually impaired*. <http://www2.echo.lu/telematics/disabl/pamaid.html>

Poulson, D., Ashby, M., and Richardson, S. (1996) *Userfit – A practical handbook on user-centred design for Assistive Technology*. HUSAT Research Institute: Loughborough.

Riseborough, M. (1997) *Community Alarm Services Today and Tomorrow*. Anchor Trust: Oxford.

SAFE 21: EC DGXIII TAP project DE 3011: *Social Alarms for Europe in the 21st Century*. <http://www2.echo.lu/telematics/disabl/safe21.html>

Sonn, U., Davegardh, H., Lindskog, A. C. and Steen, B. (1996) The use and effectiveness of assistive devices in an elderly urban population. *Aging Clin.Exp.Res.* 8 176-183.

Tamura, T., Togawa, T., Ogawa, M. and Yoda, M. (1998) 'Fully Automated Health Monitoring System in the Home'. *Medical Engineering and Physics (in press)*.

TELEMATE. EC DGXIII TAP project DE 4103. *Telematic Multidisciplinary Assistive Technology Education*. <http://www.telemate.org>

Thornton, P. and Mountain, G. (1992) *A positive response to developing community alarm services for older people*. Joseph Rowntree Foundation Community Care: York.

Bibliography

a. Publications

Cook, A. M. and Hussey, S. M. (1995) *Assistive Technologies: Principles and Practice*. ISBN 0-8016-1038-9. 712 pages. Mosby: St Louis.

EUSTAT D3402 Deliverable D03.2: *Critical Factors involved in End-User's Education in relation to Assistive Technology*. Brussels: European Commission DGXIII Telematics Application Programme.

IFMBE News. *Growing old technically – report on the IPTS report for the Committee on Science, Technology and Energy of the European Parliament*. IFMBE News, November 1997 (27), N4-N7.



b. Some National and International Services

Below are just some of the ever-widening group of national and international disability sites and organisations that share information on AT for older people. In addition to these sites there are also countless locally organised information services for people with disabilities.

Centre for Policy on Ageing: Independent organisation aiming to formulate and promote social policies to allow all older people to achieve full potential of their later years <http://www.cpa.org.uk/cpa>. There is no link to an end-user database e.g. equipment, therefore it is accessed by professionals working in the field. There are links to articles on the use of equipment by older people. A similar site is that of:

Charities such as Help the Aged and Age Concern have extensive websites with information about AT and provide free factsheets. <http://www.ace.org.uk>, <http://www.helptheaged.org.uk>

Co-Net AbleData is a North-American based CD-ROM of AT devices. The information it contains is supplied directly by manufacturers.

DesignAge <http://DesignAge.rca.ac.uk/> is an action research programme on design for an ageing population based at the Royal College of Art and funded by the Helen Hamlyn Foundation and the EC. This site gives a useful database search of articles including details on articles such as KeepAble superstore etc. fact sheets from Age Concern England.

DIAL (Disability Information and Advice Line) are local services generally run by users for users. These services often have websites associated with them.

DIEL <http://www.acts.org.uk/diel.htm> is an independent body established by Act of Parliament to advise OFTEL, the Telecommunications industry regulator, on the particular interests and needs of consumers who happen to be either elderly or disabled, or both. It produces free information packs in an effort to make people aware of what is currently available.

Disability Information Trust (Equipment for Disabled People) publishes a series of reviews of AT of many types. The reviews include an assessment of the design and function and are aimed at users carers and professionals alike. The Trust is based at: Mary Marlborough Centre, Nuffield Orthopaedic Centre, Oxford OX3 7LD

Disability Living Foundation: <http://www.atlas.co.uk/dlf/> (UK based). This is a major site again predominantly for those with disabilities however the AT covers all aspects of daily living and therefore appropriate for a wide range of users. Contents include a wide range of fact sheets on choosing and fitting equipment, information about disability living centres, training courses aimed at users, carers and professionals, the recently re-established DLF helpline and the DLF equipment and Hamilton index database. There is also a special set of guides for older people.



Disability Net: <http://www.disabilitynet.co.uk/> (UK based, Hull). Through this site there is access to a number of other sites providing information on a wide range of subjects from Government policy decisions through to holidays for people with disabilities. This is a site for those who have disabilities and as such may not be used by elderly and carers with minor daily activity/mobility problems.

Disability North: <http://www.nagd.org.uk/> this is a site aimed at promoting the work of disability groups based in the north of England. The emphasis is on people with disabilities but there are a number of links to other sites in the UK and Europe and North America. The services of Disability North are based in Newcastle and are available to anyone needing information on disability issues. It is also linked to the local Disabled Living Centre and the information and advisory service covering both equipment demonstration, and general information enquiries.

Disabled Living Centres <http://www.dlcc.demon.co.uk/homepage.html> are local centres where users and carers can try out and get information and advice about assistive technology. Lists of centres are available from: DLCC, 11 Cranmer Road, London SW9 6EJ.

ENB Healthcare database <http://www.enb.org.uk/> is predominantly for professionals involved in the field of care giving.

HANDITEL: <http://www.santel.lu/HANDITEL/home.html> (Luxembourg based). The aim of this server is to gather and classify web sites related to people who are elderly or disabled. Much of it is from the US and concentrates on the disabilities and illnesses/conditions associated with onset of old age rather than elderly per se. – similarly to the Cornucopia of disability information.
<http://www.codi.buffalo.edu/>

HandyNet is a CD-ROM based inventory of AT available across Europe. Items are classified in a uniform manner and the CD is available in all European languages. Further information on the database and how to order it is available from the Internet website <http://www.handynet.org>.

MediaAge.net: <http://www.MediaAge.net/> is an evolving electronic European news service highlighting issues related to the global age boom. It will bring relevant information and stories to those that can best use them. MediaAge networks are being established across Europe, bringing together different organisations involved with ageing and policy issues as well as media representatives and researchers.

Medical Devices Agency <http://www.medical-devices.gov.uk/> publishes occasional assessments of items of AT, critically assessing and comparing the efficacy and safety of products. The reports are not intended as a buying guide and are aimed at informing professionals rather than users. Copies are free to NHS/Social Service employees. MDA Room 2/FO5 Crown Buildings, Surbiton, Surrey KT6 5QN



TAP The Telematics <http://www2.echo.lu/telematics/telehome2.html> Applications Programme, is one of the European Commission's research programmes and is aimed at stimulating Research and Telematics development on applications of information and/or communications technologies in areas of general interest.

Visual Impairment Service: <http://www.ssc.mhie.ac.uk/VISHome.html/> is easy to use information service for all those in and concerned with the visually impaired community. It is run by the Scottish Sensory Centre in Edinburgh in collaboration with Action for Blind People, Sense Scotland and RNIB.

c. Examples of some local services

DIAL Basildon: <http://www.thurrock-community.org.uk/tcis/tc500501.htm>

DIAL Hampshire: <http://www.hants.gov.uk/istcclr/cch16419.html>

DIAL Trafford: <http://www.disabilitynet.co.uk/groups/dialtrafford/>

DISS, Disability Information Service for Surrey:

<http://dspace.dial.pipex.com/town/square/ad544/>

Norfolk Disability Information Federation:

<http://www.open.gov.uk/ndif/homestuf/homepage.htm/>