

Caring for the future: the impact of technology on aged and assisted living

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Abstract

The growth in functionality of digital technologies and the drop in price constitute one of the key trends of the modern age. And this is occurring at the same time as another significant trend - the ageing of the population. Digital technologies are increasingly being employed to help older and disabled people live more independent and productive lives. In 2005 Connection Research Services was commissioned to produce a report on the key issues in the use of technology for the aged and disabled. The research in this report identified four key areas where digital technologies can be used to improve the lives of the aged, disabled and chronically ill:

Health: *Many Australians need help in managing their health - an enormous burden on the public healthcare system. If just a small proportion can manage some aspect of their healthcare through the use of technology, the potential savings will be enormous.*

Home automation, security and safety: *Independence at home is important in maintaining quality of life, as well as decreasing the number of carer support hours needed.*

Communication: *Communication is very important for people whose mobility is limited, or who live alone. Communications technologies greatly improve the quality of life of the aged and disabled.*

Lifestyle: *The various home automation and digital technologies can benefit the aged and the disabled, improving their quality of life by enhancing their independence.*

Many people are in institutions simply because they can't cope at home. Technology has the potential to extend their physical independence, so that they can stay for longer in their homes. It gives them a more dignified life, and it saves public and private money.

Keywords: Ageing population, digital technology, assistive living, home automation

1. Introduction

In 2005 Connection Research Services (CRS) was commissioned by Connection Magazines and the Copper Development Centre to examine the interaction between two major trends – the ageing of the population, and improvements in digital technology in the home. The research was conducted because both organisations

believe the usage of digital technology by the aged will become an increasingly important issue in the years to come, and they wish to adopt the appropriate commercial strategies.

In 1984 just 10 per cent of the Australian population was over 65. In 2005 the figure was 13 per cent, but over the next 30 years the proportion will increase to 25 per cent or more [1]. We are living longer and, as we get older,

we are increasingly living alone, and with disabilities. The costs to society are increasing, and governments and individuals are looking at ways to reduce the burden.

At the same time, we are witnessing a technological revolution. Leading computer industry analyst company Gartner talks of the “consumerisation of information technology”. Increasingly, the most innovative uses of dig-

ital technology are taking place in the home. Terms like “intelligent home”, “digital home” and “connected home” are being used to describe the convergence of a range of technologies – consumer electronics, computers, communications, home automation – and their increased use in a domestic setting.

These two significant trends – an ageing population and the growth of connected home technologies – have both occurred because of improvements in technology. People are living longer because of improved sanitation, better diets, more effective drugs, and greater medical knowledge. High technology is entering the home as virtually all digital devices become less expensive and more powerful each year. Home automation and home theatre systems, once the preserve of the wealthy, have dropped in price to the extent where their usage is commonplace.

These two trends are increasingly interrelated. Connected home and related digital technologies are increasingly being employed to help older people live more independent and productive lives. And these technologies are not just being used to assist older people, but also those with disabili-

ties. Estimates vary, but the proportion of the Australian population who need daily assistance due to a disability, is as high as 15 per cent – some three million Australians. The needs of the aged and of those with many disabilities are very similar.

The research had a number of key objectives:

- to determine what is being done in Australia and internationally in this field, and to identify the key participants
- to identify potential growth areas and current shortfalls in providing digital products and services
- to investigate the attitudes of carers towards assisted living
- to investigate the understanding of ageing and disabled persons relating to digital technologies
- to provide recommendations concerning demographically appropriate marketing strategies of digital home technologies
- to identify any current gaps in research and to make recommendations for further research.

This paper is a summary of the report, which can be downloaded in PDF format from CRS’s website at www.connectionresearch.info.

2. Methodology

The data collected for the report was largely secondary – based on existing material. It included academic and commercial data from a large variety of sources. It is partly quantitative, in the form of tabulated and graphical data obtained from organisations such as the Australian Bureau of Statistics (ABS), and graphs developed by the researchers based on secondary data. The rest of the data is qualitative.

Data collection comprised several strategies. These were a literature review, interviews with experts in the field, and the use of relevant data from the CRS Connected Home Report 2005 [2] and other studies. The literature review was wide-ranging, sampling materials from sources such as journals, books, e-newsletters, government reports, and conference proceedings. The subject has begun to attract an enormous amount of research, which the report attempted to summarise.

3. Two Megatrends

3.1 Megatrend One – Older Population, More Disabilities

The ageing of the population is the key demographic issue underlying the growing need for technology services relating to assistive living. The average age of the population is increasing for two reasons. People are living longer as a result of improvements in economic conditions, public health, and medicine in both the developed and developing world [3], and birth rates in most countries have declined in recent years [4].

It is not only the aged. An increasing proportion of the population has a disability, defined as the “inability to exist at home without help” and/or a dependence - “a further degree of impairment of self-care”[5]. Generally, persons with health, physical or multiple disabilities share many of the life goals and interests as persons without disabilities[6]. But disability can greatly affect the achievement of these

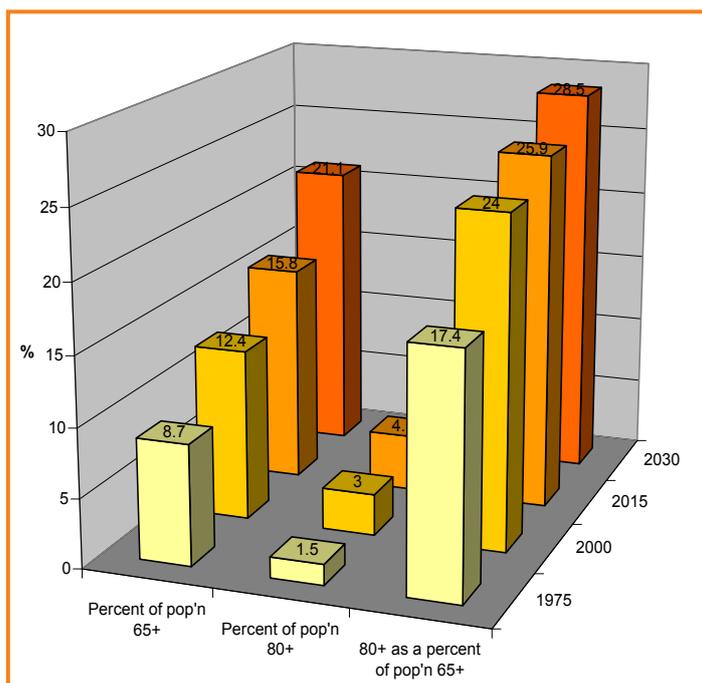


Figure 1: The Ageing Australian Population

goals, requiring significant adaptation and adjustment.

The chart shows the percentage of the Australian population aged 65 and over, 80 and over, and of 80 and over as a percentage of all persons 65 and over [7]. The proportion of the Australian population aged 65 and over will more than double between 1975 and 2030, from 8.7 per cent of the population to 21.1 per cent of the population. The proportion aged 80 and over will quadruple, from 1.5 per cent to 6 per cent.

Government policies are often based on the extent to which people are able to live independently. Australians typically experience three main living arrangements over a lifecycle: living with parents, living with a partner (for part of this time with children) and living alone in old age if the partner dies. Other living arrangements may also include living in a group household or alone before possibly forming a long-term partnership, or living as a single parent or alone after separation or divorce. Changes in these living arrangements have major implications in areas such as aged care, and in the development of government policies and spending priorities.

There are a variety of living environments to which people may progressively move as they age. This has been described as the “continuum of care” [8]. The levels within the continuum of care are home, independent apartment living, assisted living facility, skilled nursing facility, and 24 hour care unit [9]. According to Intel, each move along the care continuum escalates the cost of care and sometimes reduces quality of life. Furthermore, Intel states that digital home technologies can play a major role in allowing seniors to stay

in a particular care level before moving on to a higher level of dependency.

The following statistical projections on household types in Australia are from the ABS (Table 1). They are based on a set of three series [10]. In Series I it is assumed that the proportion of persons in particular living arrangements will remain constant from 2001 to 2026. Series II assumes that the rate of change observed between 1986 and 2001 will continue through to 2026. Series III assumes that the rate of change will be greater than Series I but not as great as Series II.

In 2026, the number of persons living alone in Australia is expected to increase from 1.8 million in 2001 to between 2.8 million (Series I) and 3.7 million (Series III). This is an increase of between 57 per cent and 105 per cent. In 2001, people aged 65 or above comprised 37 per cent of lone person households. This proportion is projected to increase to between 41 per cent (Series III) and 50 per cent (Series I).

In 2003, more than half of Australians aged 65 years or above (56 per cent) had a disability. Persons aged 65 years or above are more likely to have disabilities than younger persons, and the probability of getting a disability increases with age. Due largely to an increase in the total number of older persons between 1998 and 2003, from 2.3 million to 2.5 million, the number of older disabled people increased from 1.2 million to 1.4 million [11].

The severity of disabilities also tends to increase as people age. As a result, people tend to need increased help with day-to-day and health-related activities as they age. With baby boomers getting older and greater numbers of people generally living to older ages, questions of how to meet

the needs of increased numbers of disabled aged persons are becoming critical.

3.2 Megatrend Two – Digital Technology in the Home

Converging technologies in the home have become something of a cliché in recent years. The digitisation of media, the growth of the internet, the emergence of structured cabling standards, and plummeting prices have brought to the market a range of new technologies that are revolutionising how we live, work and play in the home.

Australians are early adopters of technology. Automatic teller machines were introduced to Australia earlier than any other country. Australia adopted VCRs and mobile phones almost overnight. The market for plasma TVs and iPods and digital cameras is booming. It has become a mark of success to have lots of devices on our person or in our lounge room.

In 2004 Australians bought 210,000 digital camcorders, 808,000 games consoles, and an astonishing 1.28 million digital cameras and 1.48 million DVD players [12]. Nearly 300,000 portable digital music players – mostly Apple’s ubiquitous iPod – were sold in the last three months of 2004 alone. The average Australian home now has 1.07 DVD players, 2.14 TVs, and 1.43 mobile phones. Nearly two-thirds of homes are connected to the internet, and over 80 per cent have at least one PC, with two or more computers increasingly common [13].

There are now over 19 million mobile phones in Australia, for a population of just over 20 million. And they are much more than phones – they are cameras, instant messengers and

	2001	Series I (2026)	Series II (2026)	Series III (2026)
Household type	'000	'000	'000	'000
Family households	5,269.0	7,030.1	6,920.0	6,714.9
Group households	293.2	345.7	371.5	403.6
Lone person households	1,805.3	2,842.0	3,149.4	3,693.0
Total number of households	7,367.5	10,217.9	10,440.9	10,811.5

Source: **Household and Family Projections, Australia, 2001 to 2026** (ABS cat. no. 3236.0)

Table 1: Types of households in Australia.

PDAs (personal digital assistants). The mobile phone is the one device most of us take with us wherever we go.

Falling prices and improvements to the technology are changing the way we use technology in the home. People are starting to integrate computers with their home entertainment systems – Microsoft’s Media Center is the most significant step down that path in recent years. The PC can be used to control the TV and the hifi, using integrated disk storage for music, film and video and recording.

The market is still very immature. It is true that we have seen amazing technological advances in recent years, and that consumers have been quick to embrace the technology. But the confusion over standards, business models, technologies and interconnectivity indicates an industry that still has a long way to go to fulfil its promises of convergence. It will happen – the growth rates are phenomenal, and the technology continues to improve in capability and price-performance.

While it is difficult to predict the effects of rapidly changing technology, it is possible to predict that it will have an effect on all age levels [14]. Technological change will bring favourable outcomes such as physical workload reduction, communication facilitation, compensation for infirmity, and improved safety of individuals [14].

The digital revolution has barely begun. The computer industry is 60 years old, and the internet dates from 1969, but it is only in the last ten years that computers have become common in people’s homes, and the internet has become easy enough for everybody to use.

In 1995 there were 6655 bank branches in Australia, Ten years later there were just 4888. Over the same time the number of bank tellers has declined by half. Today every PC is a bank branch, and we are all tellers. In 1995 Amazon was a small company struggling to survive and e-mail was a novelty. Digital cameras and iPods didn’t exist. Analogue mobile phones were clunky, expensive and unreliable. PDA still stood for “public display of affection”. The Java programming language

was announced that year, as was the first Sony PlayStation.

Since then a whole range of new technologies and services have come into being that have totally changed our behaviour and habits, at work and at play. We are surrounded by electronic digital devices. Many of us buy our cars, do our banking and read our news online. Most dating services, job ads, and encyclopaedias are already there. Newspaper circulations and cinema attendances are declining.

We can send and receive SMS messages from fixed phones, watch TV on our computers, and surf the net and take pictures with our phones. Wireless communication is widespread, for voice and for data, and the day of seamless integration of wired and wireless networks is almost upon us. The internet, only a baby ten years ago, has matured. We rely on it and we trust it.

The key has been the movement of information from analogue to digital. Analogue signals represent information as waves. All analogue signals are different, and storage or retransmission means an inevitable loss of quality. With digital, all information is expressed as zeroes and ones, which means we use the same technology for storing and transmitting all media and all computer-based information. TV, CDs (and now mp3 players), DVDs, and telephony all comprise a string of binary digits, called bits. Digital signals can be stored, copied and retransmitted an infinite number of times with no loss of quality and at virtually zero marginal cost.

Most new technologies reach what many analysts call an “inflection point”, the stage at which the technology is sufficiently mature and there are enough suppliers and users to ensure a critical mass of activity. That is now happening with technology in the home.

4. Four Ways Digital Helps the Aged and Disabled

4.1 Health

Most western countries are seeking to improve the quality of life for aged, disabled and chronically ill persons. They are looking to do this by fostering increased independence, and through the more efficient and cost-effective delivery of health services. Technology plays a key role in this process.

The development of technologies such as smart phones and smart homes, connecting PC technologies, communications and entertainment, are bringing medical technology into the domestic environment. Indeed, it is in the area of healthcare that the increased capabilities and falling costs of digital technology are having the most significant effect on people’s lives.

Healthcare costs continue to rise in most countries. Ageing populations mean they will continue to do so. For example, in the twenty years leading up to the turn of the century, US expenditure on national health care increased by 50 per cent [15], to more than \$US1.5 trillion annually [16]. In 2005-06 the Australian Government spent \$45 billion on health and aged care, more than double that spent a decade earlier [17].

Many attempts have been made to curb the increase, including the introduction of various cost-cutting strategies. In the USA this has led to the shift of cost containment risks to private providers [16], with hospitals bearing the costs if doctors or clinics underestimate the length of a patient’s stay or treatment costs. This has had significant ramifications, including policies of targeting shorter hospital stays for patients.

The term “telemedicine” has historically referred to the use of telecommunications technology to provide, enhance, or expedite health care services, by such means as accessing off-site databases, linking clinics or

physicians' offices to central hospitals, or transmitting x-rays or other diagnostic images for examination at another site [18]. With the rapid evolution of telecommunications technology into the home, the term is also being used to describe the increased trend towards the delivery of health services by electronic means into the domestic environment. Often this is called "telecare".

Elderly and disabled people may need help with activities such as preparing meals, moving around in the home, property maintenance, housework, and managing their health. As they age, their requirements tend to increase. In 2003 the ABS estimated the total number of disabled people aged 65 and over in Australian households at 1,232,200 – over one million. The ABS also found that 69 per cent of them reported a need for some assistance [19].

The main activities they reported needing help with were property maintenance, healthcare, transport, housework and mobility. Less common needs were assistance with self care, meal preparation, and paperwork. Some people needed assistance with cognition or emotional issues, such as thinking through problems. Between 1998 and 2003, the proportion of older disabled people who needed assistance with self care, healthcare, and mobility increased significantly.

Almost all people with severe or profound activity limitations need assistance in at least one core activity area [19]. A majority require mobility assistance, just over half with self care, and

around 10 per cent with communication. They are also very likely to need help with other daily tasks such as transport, property maintenance, healthcare, and housework. Approximately a third need assistance with meal preparation and paperwork, and more than a quarter with cognition or emotion.

Through assistance to people at home with the activities of daily living and compensating for any deficits of function caused by dementia, people are able to stay at home longer and maintain higher levels of independence [20]. There are a number of proactive computing applications being developed to assist ageing persons in the home environment. These are designed to predict the user's needs and proceed to meet such needs. Wireless sensors, for example, can also be used to gather behavioural and biological data, to be used as input for the computer applications. The ultimate goal is to increase the independence of seniors by developing computerised assistants.

Assistive digital technologies include the following: [21]

- Radio/ultrasound/remote controlled appliances
- Captioning
- Phone amplifier
- Personal amplification system/hearing aid
- Portable scanner with word processing templates
- Alternate keyboards
- Mouth stick/Head Master/Tracker with on-screen keyboard

- Voice output devices
- Talking watches, clocks
- Calculator with print out, large keys, talking feature, and/or large display.

4.2 Communications

The key tool in maintenance of social networks, including family ones, is communication. Communication is important to us all but, for people whose mobility is limited, or who live alone, it can become paramount. Both telephony and the internet comprise an array of increasingly sophisticated technologies which provide users with many different ways to communicate. The convergence of services from the mass media, IT, and telecommunications industries has led to development of a variety of products, such as VoIP (Voice over Internet Protocol), broadband and mobile TV, and mobile data and content [22].

These communications will become increasingly seamless, with virtually uninterrupted communication possible as the user moves from their home to their car and to external places such as work. Telstra and other carriers are talking of the "next generation network" (NGN), which will merge all existing communications networks into one "supernet".

The distinction between the telephone, television and internet networks will disappear. This process has already begun, with some carriers offering "triple play" (pay TV, telephone, internet) services over the one net-

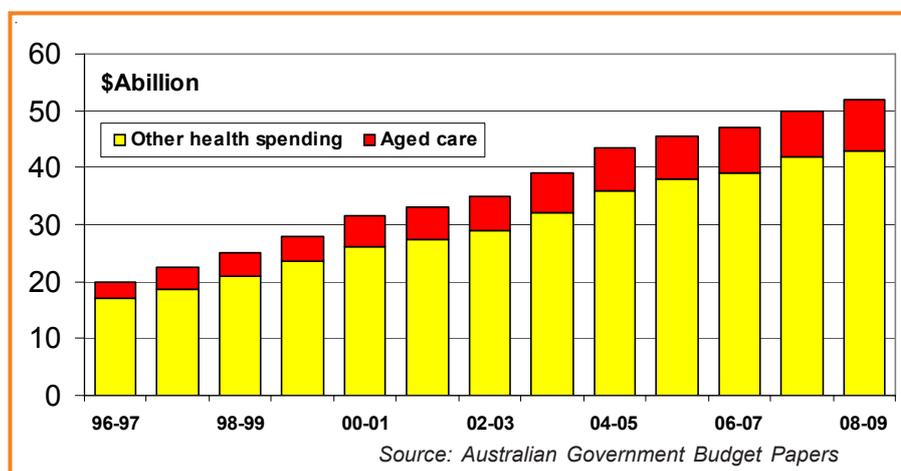


Figure 2: Government Health Care Expenditure in Australia

work. The first such service in Australia has been provided by TransACT in Canberra. Other technologies, such as BPL (broadband over power lines), being implemented by Aurora Energy in Tasmania, also hold significant promise.

Radical new thinking is required in market strategies for new wireless technologies due to the turbulent environment now faced by providers [23]:

The analysis of hundreds of innovations in dozens of industries has led to the development of disruption theory, which shows that it's usually better to start by commercialising potentially disruptive technologies in markets that are much smaller and less demanding. Consequently, providers of wireless telecom services – whether voice, data or video – should experiment in carefully selected foothold markets to master new applications, essentially getting paid to develop and introduce improvements that will give them a structural advantage when moving into mainstream markets.

Disruptive technologies include media such as books, films, and music being digitised, devices getting smarter, and the rapid growth of broadband internet [24]. Many companies are developing a number of cutting-edge technologies to enhance communication. These include connected home technologies such as telephone with a rich visual display, a PC-like keyboard, and a sensor network that looks for sudden declines in social contact [25]. These types of technologies can assist persons with mild cognitive impairment to remain engaged socially for as long as possible. They can also provide on-site carers with social support to make them less isolated, and allow family members to keep track, online, of the health of ageing parents.

Aged and assisted living environments comprise a niche market, which is affected by some variables differing from those impacting the general communications market. Therefore, it might make sense to experiment in a foothold market such as carefully selected aged care institutions before committing to an overall strategy on mobile services

to the aged and disabled. But examples of communications services specifically designed for the aged and disabled are emerging.

Post-och Telestyrelsen (PTS), the Swedish government's postal and telecommunications regulatory agency, has been experimenting with services which allow aged and disabled persons to access postal and telecommunications services [26]. They are mainly designed for persons with visual or hearing disabilities, but may extend to other groups. These services include:

- Free directory enquiries for people with certain functional disabilities.
- Relay services for text telephony. When people who are deaf or have speech impediments use their text telephone to communicate with someone with a regular telephone, the call is simply relayed by an operator using a telephone and a computer with a text telephone program.
- Relay services for video telephony. When people who use sign language use their videophone to communicate with someone with a regular telephone, the call is simply relayed by a sign language interpreter using a videophone together with a regular telephone.
- Relay services for people with speech defects. This is a service used by people with speech defects, where a speech therapist helps users to communicate.
- Health care information service for those who use a text telephone.
- Sending mail in Braille between people with visual impairments, as well as from institutions and public libraries.
- Extended rural postal delivery service for the elderly and the disabled.

Trials of electronic communications and post services for disabled persons, carried out for PTS, indicated that there is a need for increased flexibility and

mobility for disabled users, and also better information about the services available, including the aids needed to use the services [27]. Usability and accessibility were found to be main factors enabling disabled persons to use the new technologies. The analysis found that e-mail and the internet presented the least problems generally, while most limitations related to chat and mobile telephony.

4.3 Home Automation

The need to maximise independence at home is of high importance in maintaining quality of life as well as decreasing the number of carer support hours needed by the individual [28]. A number of new technologies are being developed which have the potential to enable people to remain in their homes for longer periods and later in life than was previously possible, postponing the need to live in high-dependency, assisted care institutions.

Home automation is sometimes called domotics (from the Latin domus, house). It refers to the application of information, robotic and control technologies to domestic appliances and the house itself.

Home automation enhances home and lifestyle by deriving more benefits from electronic and electrical home equipment. Basic home automation includes structured wiring for telephone, internet, video and local area network (LAN). More advanced home automation includes multi-room audio, home theatre, lighting control, keyless entry and security. The technology can also include the control of blinds, air-conditioning, exhaust and ceiling fans, watering, and other appliances such as programmable wall switches, touch screens, telephones and personal computer [29].

For example, the Australian Smart Wired House initiative, which specifies integrated wiring for television, telephone, internet, audio, lighting, security and garden irrigation, has been developed by the Copper Development Centre Australia Limited (CDC) [30]. Partners in the Smart Wiring initiative include Clipsal, HPM, Krone, Pirelli, Belden, Universal Systems, LG

Electronics, Cisco, BHP, Crane Copper Tube and MCK Metals Pacific.

A key aspect of many home automation systems is the incorporation of security and safety features. Many people perceive that crime rates are rising, and the increase in the number of people living alone adds to concerns about security. One study [34] found that security ranks ahead of house size, energy efficiency, communications, land size, and usability in factors people take into account when purchasing a home. Aged persons, disabled persons, and chronically ill persons may need greater assistance in attaining heightened safety levels. It has also been suggested that women generally, regardless of age or health, benefit from the availability of increased security [31], and most aged people living alone are women. Digital surveillance technologies and remote monitoring enable greater levels of security and safety, by making it much easier to monitor sites over the internet via a PC or even a mobile phone.

Sensor networks can also monitor the activities of residents. These can be used for medical purposes, but they can also provide data input which will trigger assistance potentially required in household tasks such as cooking. Users can access their home networks via a number of familiar interfaces such as televisions and telephones. According to Intel, the users “will not need to learn new technology to receive assist-

ance” [32]. This outcome has enormous potential in providing user-friendly technology which is more likely to be embraced by possible users.

4.4 Lifestyle

Home automation and digital technologies can benefit the aged and the disabled in terms of their quality of life, by enhancing and even enabling their independence. This is explored above. But in the wider community the most popular use for this type of technology in recent years has been for lifestyle reasons – mainly to provide entertainment.

The aged and disabled enjoy entertainment as much as anyone else. Indeed, the provision of entertainment in the home may hold a more important part in their lives because of their relative lack of mobility. The enhancement of entertainment and other lifestyle experiences through the usage of digital technology is therefore an important issue, though one in which usage by the aged and disabled may not differ significantly from the population in general.

But lifestyle is not only about entertainment. One increasingly important aspect of the digital revolution is the use of the internet as a transactional medium. Home banking and shopping via the internet are technologies that have the potential to enhance inde-

pendence, and therefore improve the quality of life of the less mobile, which includes many aged and disabled. Goods and services can be conveniently purchased online and delivered direct to the home, greatly improving the access to these services for people with restricted mobility.

An increasing number of digital electronic devices are becoming available for use in the home. Some have been available for some time, but widespread usage has occurred only in recent years as prices have dropped to affordable levels. The CRS Connected Home Report 2005 [33] was a survey of over 1000 Australian households, selected at random, asked a number of demographic questions, including age of respondent, and included questions about whether a range of electronic devices were installed in the respondent’s home.

The data in the table below shows not whether the person uses the device, or how they use it, but whether they live in a house which contains the device type. Responses to the survey, conducted by a telephone poll, were broken down by the age of respondent. Other demographics, not shown here, included income level, home ownership status, geographic location, and employment status.

The data show that, generally speaking, usage (as defined by the likelihood of a random person living in a household containing such a device) of vari-

Device Type	Average	Under 20	20-30	30-40	40-50	50-60	Over 60
Desktop PCs	71.9	77.6	72.1	77.5	78.9	77.5	55.2
Laptop PCs	28.0	30.8	38.4	30.5	35.2	28.1	13.2
Games Consoles	38.5	77.3	59.1	53.7	47.2	29.4	5.3
PDAs	9.6	11.9	9.6	12.5	14.1	6.5	4.9
Digital Cameras	47.3	55.2	61.7	49.1	58.3	48.2	25.6
Digital Camcorders	16.7	29.9	16.4	21.1	18.2	16.7	8.4
Mobile Phones	83.1	91.0	87.4	86.2	92.9	89.9	63.6
DVD Players	77.4	92.5	89.6	83.8	81.3	81.2	55.6
CRT TVs	97.7	98.5	95.6	98.3	97.5	98.8	97.8
Non-CRT TVs	6.3	12.1	10.4	7.1	7.7	1.8	3.6
HiFi Systems	75.5	69.2	77.6	83.7	83.3	78.6	60.2
MP3 type Players	17.4	34.8	21.6	14.7	27.2	12.2	6.3
PayTV	23.8	23.5	26.6	27.9	28.4	27.0	13.2
Home Theatre	15.4	17.6	24.5	19.6	18.6	13.2	5.0

Table 2: Percentage of households with devices, by age of respondent.

Source: 2005 Connected Home Report, CRS

ous electronic devices does not vary significantly by age, excepting that it tends to decline sharply for people over 60. The data indicates a consistently lower level of usage of most entertainment devices amongst the over 60s. This could be a function of conservative buying habits (they were not brought up in the era of easy credit and instant gratification), but may also be a function of conservative usage habits – some older users may feel intimidated by the technology.

5. Conclusion

Two of the key determinants of life in the early 21st century are demographics and technology. Two of the key trends arising from them are the ageing of the population and the increased proliferation and lower price of digital technology. These two trends are starting to overlap – more and more people are looking to digital technologies to help older people, and those with disabilities, to live more independent and satisfying lives.

Digital technology brings benefits not only to the individual, but also to society. More and more older people are ending up in hospitals and institutions because they can't cope at home. They are putting a strain on the public health system, and making it harder for people who really need to be in care to find a place. Technology has the potential to extend their physical independence, so they can stay in their homes longer. It gives them a more dignified life, and it saves public and private money.

Complete independence may not always be possible. It depends on the person's age and ability and on the type and severity of disability present. But even small improvements can make significant differences to quality of life and to the expense involved in caring for the aged or disabled.

We are all growing older. As we do so we may well come to regard the digital home, and its ability to enhance and maintain an individual and fulfilling lifestyle, as the greatest gift technology can bring. As the baby boomers near retirement age, a generation that

has grown up with technology will find that it is not just useful for work and play, but that it has become one of the necessities of life.

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