

Computer use has no demonstrated impact on the well-being of older adults

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Abstract

Technology is frequently presented as a panacea for the support needs of the ageing population, based in part upon the commonly-cited assertion that computer and internet use has an empirically verified positive effect on the well-being of older people. In this paper we review the studies that this assertion is based on and conclude that they do not support it. While the original studies rarely make unsupportable claims, the secondary literature which cites them is frequently very misleading; limitations include, failure to distinguish between the effects of training/ support and computer use; misattributing causality; inappropriately generalising results from a different population.

Keywords

Older adults; computer use; well-being.

1. Introduction

In this paper we examine the research evidence for the assertion that computer use improves the well-being of older adults. This assertion surfaces in much of the literature on older users, and contributes to a technocentric view of ageing that is not justified by the available evidence. By examining and critiquing the studies upon which this assertion is based, we demonstrate that the assertion is not supported: there is no evidence that computer use improves well-being among older adults.

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1.1. Background

In the “developed” parts of the world we live in ageing societies in which technology is of increasing importance in everyday life. Given this conjunction, it becomes ever more important to examine the ways in which technology serves the older population. There is a need not only to focus on the detail of usable interfaces for older people, but also to examine the wider implications of the introduction of technology into their lives.

Concerns among gerontologists that “technology is growing faster than its implications can be understood” (Coulson, 2000, p.314) must be taken seriously. If HCI specialists are, as Pew suggests, responsible for ensuring “that the technological capabilities that are thrust on us will be manageable and responsive to human requirements” (Pew, 2003, p.15), then we are responsible for ensuring that the computer systems introduced to older people, especially to those who are frail and vulnerable, are manageable and responsive to their needs. Fisk et al (2004) write that designers hold the key to increasing the quality of older adults’ lives, but in order to ensure that technology does improve people’s lives we need an accurate understanding of the way in which technology fits into their lives and the effect it has upon them.

While the field of human-computer interaction is notably interdisciplinary (e.g. Myers et al. 1996), it is arguable that human-computer interaction for older people is even more so, overlapping with, among other fields, nursing, gerontology and social work. Issues of accessibility and the digital divide also involve both law and political science.

Interdisciplinary richness contributes to some of the important and exciting research in this area, but also generates what can be described as ‘boundary issues’ between disciplines, particularly when the cultures and means of reporting research in one discipline differ from those in another. It is important that when we benefit from the interdisciplinary research that addresses the issue of technology and older people we apply the same rigorous standards of scientific evidence that we would use in our own disciplines. Apart from the important research quality issues, the sensitive decisions we make about the introduction of technologies to older adults can only be as good as the research that they are based on. It is important to be careful: the inappropriate

introduction of technology to domestic and care contexts can have significant negative consequences for some individuals (Dewsbury et al. 2004).

2. Computers and well-being

In the “developed” world, especially in Europe and the United States where the majority of younger adults are online, personal computers and the Internet are widely seen as having the potential to improve the well-being of older adults; these potential improvements are normally attributed to increased opportunities for communication, information and entertainment, as well as to the services that can be accessed without leaving home. Although in some cases the benefits are attributed to specific software packages, such as rehabilitation software (Frydenberg 1988), in general the advantages are seen as being associated with all-purpose computer and Internet use (see, for example: Becker 2004; Blake 1998; DTI, 2000; Furlong, 1989; Swindell 2001; Worden et al. 1997; Zemke, 1986).

The term “older adults” covers an extremely diverse group: one of the difficulties of the research is that the participant groups vary from fit, independently living older people to frail people in nursing homes, and research done with one group cannot be applied to the other. Despite this diversity, most people over 65 do not own or use computers (Selwyn et al. 2003), and usage trends in the UK between April 2003 and October 2005 show that 80% of those over 65 have never used the Internet (ONS, 2006).

Equally, a concept as apparently nebulous as “well-being” demands some explanation. The sources discussed in this paper define it in a variety of ways, using characteristics like loneliness, self-esteem, depression and perceived life stress. They are measured in different ways, varying from informal questionnaires (Danowski and Sacks, 1980) to formal psychometric measures (McConatha et al. 1994; White et al. 1999, 2002).

3. The evidence

While it is hard to deny that computer and Internet use have the potential to support some older adults, far stronger claims are made in the literature: it is claimed that research has demonstrated that computer and Internet use measurably improve the well-being of older adults (see, for example, Barnett and Adkins, 2004; Chaffin and Harlow, 2005; Jones and Bayen, 1998; Lai et al, 2004; Leung and Lee, 2004; Lin et al., 2004; Namazi and McClintic, 2003; Opalinski, 2001; Powell et al., 2003; Richardson et al., n.d; Saunders, 2004; see also: Brown, 2004; Czaja and Lee, 2003; Morrell et al., 2004). This asserted effect of computer use on well-being in older adults is, when referenced, based on a restricted set of sources, cited throughout this literature.

The few sources upon which this assertion is based come from a variety of disciplines and report their results in different ways; the way in which secondary papers (that is, those citing the results) report the research outcomes is often quite misleading. In this paper we will review these sources and the evidence they provide for the assertion that computer use improves the well-being of older adults. A summary table of the sources covered is provided at the end of the article.

3.1. *Inclusion criteria*

The primary source papers included in the analysis were published in the English language in peer-reviewed journals. Their authors set out to evaluate the impact of general computer/ internet use on the “well-being” or “quality of life” of adults over 50, in studies that used a quantitative methodology. Secondary sources were those papers which cited the primary sources to support a claim that general computer or internet use has an impact on the well-being or quality of life of people over 50. Papers were selected that focused on personal computer use. One exception to this is the Cody et al (1999) paper which discusses the use of Web TV; it is included because others have cited it to argue that internet use improves well-being. Where unpublished reports, PhD theses or conference papers were accessible and thus part of the “open” literature they have been included.

3.1.1. Search Strategy

References listed in appropriate sections in the Morrell et al. (2004) research and literature survey on older people and technology were acquired and, where suitable, included in the analysis. Databases searched were: Pubmed, Google Scholar, Ingenta, ISI Web of Knowledge, ACM Portal; search terms were permutations of “elderly”, “older”, “senior”, “wellbeing”, “well being”, “quality of life”, “computer*” and “internet”. Abstracts were reviewed and those fitting the criteria of the study were included in the analysis. This approach was supplemented by tracking the references made in all the papers utilised. Papers citing the primary source papers were also sought through the “cited by” facility on Google Scholar; abstracts were reviewed, appropriate papers ordered and those which used the primary sources to justify a claim that general computer/ internet use was *causally* connected to differences in well-being or quality of life were included.

3.2. Intervention Studies

Most of the studies cited in support of the assertion that computer use improves the well-being of older adults are ‘intervention’ studies in which various well-being measures are taken before and after computers are introduced into people’s homes. These vary widely in terms of the number of participants, the measures taken and the extent to which the studies were controlled.

The earliest study that is cited to support the assertion that computer use improves well-being, in this case by reducing loneliness and increasing self-confidence/ self-esteem, is the 1980 publication by Danowski and Sacks (cited in this context by, for example, Jones and Bayen, 1998; Namazi and McClintic 2003; Saunders, 2004). In this study statistically significant differences were found between pre- and post-intervention answers to the questions: “Do you think using the computer would make you more confident in yourself?” and “Do you think using the computer would make you feel less alone?” These results should be treated with some caution. The first reason to be cautious is that

the pre-intervention questionnaire was answered by 30 participants, and the post-intervention by only 13. Danowski and Sacks themselves admit that a possible explanation is that those with more positive attitudes would have been more likely to continue in their participation and answer the second questionnaire (p.131), suggesting that answers to the second questionnaire would be more positive as a result of the sample difference, and not because of a change in attitudes. Second, the study was informally structured: lectures on human-computer interaction were given weekly for three weeks and residents were free to use a computer terminal set up in a communal area. Third, a trainer was present, a newsletter was produced and training was normally given in groups. It is difficult to attribute the change in attitudes to computer use rather than to the effect of the lectures or the training and communal interaction around the computer. Finally, the questionnaire used was rudimentary, consisting of only six items, two of which concerned well-being, and there is no evidence that it was piloted, standardised or otherwise evaluated before use. While this is not a fundamental criticism of the interest of the research, the questionnaire cannot justify the strong claims about the connection between computer use and well-being made in some of the subsequent literature which cites this paper as evidence.

A study which, by comparison, used standard measures and a controlled experimental design was the 1994 study by McConatha et al. (1994). The authors describe the study as examining “the effects of interactive computer-based *education and training*” (p.553 – emphasis added), although the title of the paper (“The use of interactive computer services to enhance the quality of life for long-term care residents”) is less cautious. It is described in the secondary literature as showing that “the use of computers by institutionalized seniors... decreased depression and improved cognitive functioning” (Straka and Clark, 2000, p.3;² see also: Whyte and Marlow 1999). The six month project had 14 participants in the intervention group and a matched control group. Pre- and post-intervention measures included an assessment of Activities of Daily Living, the Geriatric Depression Scale and Mini-Mental State instrument, used to assess recall and language.

² See also: “Internet use dramatically improved the mental health of seniors in nursing homes with disabilities” (http://www.accentcare.com/Resources/article_the_computer_age.aspx)

All of these measures showed statistically significant changes between pre- and post-intervention. However, strong as these results are, they do not support the argument that *computer use* improves well-being. The intervention had a very high level of researcher, staff and participant interaction: training, ongoing support and volunteers from among the participants working in a “buddy” system. It is possible, even likely, that the improvements in well-being are attributable to the training program and interaction with other learners rather than to the use of the computers themselves.

Therefore, the difficulty in using either the Danowski and Sacks (1980) or McConatha et al (1994) studies to argue that computer use has an effect on well-being is in attributing the changes exclusively to *computer use* without considering the possible effects of the training and interaction that accompanied it. In neither study was an attempt made to separate the effects of computer use from the effects of the training process and the context in which computers were used.

Two studies which are widely cited as providing evidence that computer use reduces loneliness, but which, in fact, inadvertently lend more support to the argument that training and interaction are the most important aspects of the interventions, were carried out by White et al. (1999; 2002). These studies have been cited as providing evidence of the “benefit of computers” (Saunders, 2004, p.575) and it has been suggested that they demonstrate that “*access to the Internet and e-mail can have a positive impact on the quality of life of older adults by increasing social interaction*” (emphasis added) (Namazi and McClintic, 2003, p.536; Segrist, 2004, p.564; see also: Chaffin and Harlow p.310; Leung and Lee, 2004; Lin et al. 2004 p.262; Powell et al. 2003; Richardson et al., n.d.; Straka and Clark, 2000).

White et al (1999) reported on a 5 month pilot study with 15 participants and a small control group (n=8). Participants went through a two week training program in computer use, well supported by a group of researchers and volunteers, and were encouraged to work together in groups. Following the training period, only the intervention group was interviewed and showed a statistically significant reduction in loneliness compared to

baseline using the UCLA Loneliness Scale. At the study end, however, when the measures were repeated, no statistically significant results were found although the authors suggest that a “trend” existed toward reduced loneliness for the intervention group. Given that the statistics reported in support of this trend show a p value of just 0.17, any perceived trend is highly tenuous at best.

Against the background of the suggested trend in their 1999 study, White et al. (2002) carried out a larger-scale, randomized and more carefully controlled trial which could perhaps lay claim to being the definitive exploration in this area to date. From an initial intervention group of 51 participants, data was collected from 48 (9 of whom had failed to complete the training) after 5 months and from a control group (n=45). The measures included the UCLA Loneliness Scale and the CES-Depression Scale (both of which had been used in the previous trial) but no statistically significant results were found.

The White et al studies, then, do not support the statement that computer use has a positive effect on the well-being of older participants, despite the fact that they are cited as doing so (see, for example, Chaffin and Harlow, 2005; Namazi and McClintic, 2003; Leung and Lee, 2004; Lin et al., 2004; Powell et al., 2003; Richardson et al., n.d.; Saunders, 2004; Segrist, 2004; Straka and Clark, 2000). The single statistically significant result from the 1999 study is confounded by the training process: it seems probable that the decrease in loneliness that the researchers detected owed more to the intensive two week training process, with support and collaborative working with others in the housing complex, than it did to computer use itself. This is especially likely as the effect had disappeared by the end of the study. The authors themselves recognised the potential confound of the training process and reduced the amount of support in their second study. The lack of any statistically significant results from this study, however, only supports the argument that the initial result was as likely to be attributable to the training process as to computer use. The repeated mention of a “trend” towards reduced loneliness is unfortunate since this (questionable) association is reported without the accompanying statistics in the literature.

White et al themselves must take some responsibility for the misrepresenting of their study results in the literature because they report the rather misleading statistical “trend”; similar research has also been reported inaccurately in the secondary literature, however. A particularly illustrative example is the study carried out by Cody et al. (1999) with an initial participant group of 292 people introduced to Web TV through a four-month training program. The study focused in part on the differences between those who completed the training program (52%) and those who left it before the end, calculated by a variety of measures given before the intervention began. Significant differences between the two groups were found, but it is the way in which these have been reported that is potentially confusing. Czaja and Lee (2003) describe the study as showing that “older adults who learned to use the Internet had more positive attitudes towards aging, higher levels of perceived social support, and higher levels of connectivity with friends and relatives.” (p.417). While this description is accurate, it also illustrates the difficulty of reporting this study unambiguously: it is not clear from this description whether these characteristics were predictors or results of Internet use. Blit-Cohen and Litwin (2004) are more misleading: “Those who obtained the necessary skills to utilize the Internet reported having higher levels of social connectivity, higher levels of perceived social support, and generally more positive attitudes toward aging.” (Blit-Cohen and Litwin 2004, see also: Saunders, 2004). The research by Cody et al. actually demonstrated that social connectivity, support and positive attitudes towards ageing (‘subjective well-being’) are all *predictors* of learning to use the Internet through staying with the training program: the study does not support the argument that Internet use has these *effects* on well-being.

The results on the effect of staying within the training program and using the Internet were less clear. Although the authors hypothesized that ongoing Internet use would affect attitudes to ageing this hypothesis was not supported, although a statistically significant correlation did exist between staying in the training program and improved measures of social support and connectivity. Once more, however, it is difficult confidently to attribute these results to the use of the Internet itself: weekly training was given to participants by a trained facilitator and, as the authors note, participants often helped each

other to use the Internet. It is equally likely that the increased measures of social support and social connectivity are attributable to the training and the increased social contact provided by computer classes.

An unpublished study that makes the social effects of computer training more explicit was carried out by Straka and Clark (2000). They provided frail older adults with computer and internet access for an hour a week for six months. Participants interacted with the computers during supervised sessions only; there were nine weeks of teaching, and throughout, participants were supported by a consistent group of volunteers. The authors note that most participants relied on the volunteers to help them use the computers and that close and supportive relationships were built between participants, volunteers and the teachers.

It should not be implied that the researchers in this area are unaware of the potential confound of the training process. A study that uniquely tried to control for the training/interaction effect was published by Billipp in 2001. The user group consisted of vulnerable older adults living at home (n=40). None of the participants had any computer experience. Participants were randomly assigned to one of four groups:

- no computer
- computer with initial training session
- computer with weekly training from a visiting nurse
- computer with training from a friend or relative

All groups received weekly visits from a nurse for the three months of the study. Measures included the Rosenberg Self-Esteem Scale and the Geriatric Depression Scale. The difference between pre- and post-intervention measures showed significant changes in self-esteem and depression. However, these changes took place only for those participants trained by a nurse. Participants trained by a friend or relative showed an improvement in self-esteem but also an increase in depression. The simple presence of a computer had no effect.

This study is as close as any research in the area to demonstrating that the use of computers alone has no effect on well-being, although the use of computers in combination with nurse training does have an effect. Whether the computers are a necessary element remains open to question; it may be that the training process alone is responsible for the changes in people's well-being. The finding that computer training from a friend or relative increases depression in a vulnerable older sample should recommend caution to those who advise general introduction to computers for this user group. Billipp herself is cautious about her results, suggesting that they should be used "to generate new questions and encourage further investigation, not to draw conclusions or to generalize to a larger, more diverse population." (p.143).

The citation of work like Billipp's in support of the positive effect of computers on well-being in frail older adults is particularly vulnerable to being truncated and therefore being misleading. One example is that some authors use it to support the argument that *computer use* brings "significant benefits" (Barnett and Adkins, 2004), a statement that the evidence does not justify.

The available intervention studies, therefore, do not support the argument that computer use has an independent effect on the well-being of older people, although they provide some evidence that appropriate training does have an effect, but no evidence that the training has to relate to computers. We will briefly discuss some other papers that are used to support the assertion.

3.3. Other Studies

Although most of the studies cited in support of the link between computers and well-being are intervention studies, one questionnaire study is also widely used to support the connection: Wright's study of online social support with SeniorNet members. Wright (2000) used a sample from those visiting the SeniorNet site: his on-line questionnaire was linked to the site for three months and received 136 responses. In terms of well-being, Wright found two especially significant correlations: first, participants who spent more

time online were more satisfied with their on-line networks; second, there was a negative association between online network involvement and perceived life stress.

Wright found that older adults who spend longer online are more likely to be satisfied with their on-line social network (defined as people met and communicated with through the Internet), and by comparison, those who spend less time online are more likely to be satisfied with their non-Internet network. It is difficult to attribute causality in this relationship, although Wright suggests that “satisfying Internet relationships may involve frequency of communication” (p.108) and implies that the amount of time that people spend online determines how satisfied they are with their online relationships. Blit-Cohen and Litwin suggest that the implication of this is that “to the extent that elderly individuals develop expertise in communicating through the computer, they prefer to make use of it” (Blit-Cohen and Litwin 2004 p.388). Although this is a plausible explanation for the findings, it is also possible that people with satisfying non-Internet social networks do not feel as much need to seek companionship online, and those who spend a lot of time communicating with on-line friends do so because of their unsatisfactory non-Internet relationships.

Another interesting correlation reported by Wright is that between perceived life stress and network involvement. Various papers have reported this finding in more or less confusing terms: Chaffin and Harlow (2005) describe Wright’s study as showing: “the more involvement older adults have with the online community, the lower their life stress”; Leung and Lee (2004) suggest that the study “found that greater involvement with the online community was predictive of lower perceived life stress” (p.6). Eastina and LaRose state that: “the level of participation in online support communities decreased perceived life stress” (Eastina and LaRose 2005). These statements mis-represent the finding; causality cannot be attributed: it may be that being a member of an online community reduces life stress, but it is equally likely that the extent to which one is suffering life stress predicts the extent of (perceived) involvement in online communities. Wright simply found an association between the two and the misunderstanding that online involvement somehow reduces life stress has spread through the literature.

The limitations of Wright's study are not solely concerned with the attribution of causality; the sample was self-selected and heavily skewed towards younger (mean age: 62.14), highly educated, high-Internet communicators (14 hours a week on average). Those older adults who were responding to on-line questionnaires in 1998, when the study took place, were also relatively early adopters of the Internet.

4. Wider Literature

A number of other studies have been carried out which also address the issues of older adults, well-being and computer use. Various explorations have taken place of the use of computer-based technologies in supporting older adults and, incidentally, in affecting their well-being. It is not the focus of this paper to explore these related studies but it is worth noting that many of the same problems with avoiding training and support confounds exist for these as well. Hanson and Clarke (2000) in evaluating the ACTION system which used television and a video telephone as well as a personal computer, note that positive responses from two of their three participant pairs are difficult to attribute to the technology. They note: "it is difficult to attribute the benefits perceived by carers to the ACTION system as opposed to the relationship developed with the research nurse" (p.136). Indeed, in a subsequent study they note that while the lives of two of their participants had been enriched, "it was quite apparent that Thomas' [the research nurse] presence had been a key factor" (Hanson et al. 2002, p.869).

One of the reasons for the paucity of suitably controlled research in this area is the difficulties inherent in the environment: work by Namazi and McClintic (2003) and Sherer (1997) reports on some of the difficulties involved in properly controlling research of this kind. Sherer's investigation of computer attitudes in a home for older people showed an improvement in computer attitudes for both the experimental and the control group, with no significant differences between them. This may well reflect the difficulty of cross-group contamination: the control group, who did not get access to the computers, were nonetheless part of the same community, saw them being used and heard them

discussed. Namazi's study of the introduction of computers to residents in long-term care concludes with a list of the barriers encountered to computer use, and to the smooth running of the project.

Work by Czaja et al (1993) demonstrates another problem with controlling the research environment. Even their highly simplified "communication system" necessitated training and ongoing support for users, who were also encouraged to contact each other using the system. Although well-being measures were taken at the beginning of the project and six months later, the results are not reported in the paper, which focuses instead on the usability of the system.

There are various qualitative studies that examine issues related to well-being in terms of computer and Internet use. McMellon and Shiffman (2002) illustrate the enthusiasm of researchers for computers and the Internet, recommending that "practitioners consider encouraging older people to take up computing and go on the Internet" (p.173). Their recommendation is based on their survey of 286 older computer users, recruited through SeniorNet and other email lists. They report qualitative responses that show that, for some older people, computers and the Internet are empowering. However, the selection of a sample group who already used the Internet, and the very low response rate (7.2%), raise questions about how far these results can be generalized.

Blit-Cohen and Litwin (2004) carried out an interview-based qualitative study with 20 participants selected from a group attending senior centres. Participants were evenly divided between those who used computers and those who did not. The study results showed a pattern similar to the study carried out by Cody et al. (1999). Computer users reported more positive attitudes towards ageing, whereas non-users were "more passive and resigned" (p.393). The difficulty of attributing a direction to this relationship is recognised by the authors, who admit that this effect may be based on an a priori difference: that is, people with positive attitudes to ageing are more likely to choose to learn about computers, and to do so successfully.

5. Conclusions

Although qualitative research indicates that for some older adults computer use does lead to self-perceived improvements in well-being, there is no research-based evidence to support the assertion that computer use alone has a more general (and measurable) effect on well-being among older adults. This is especially important because of the general misconception in the literature that such a connection has been found. Whether this perceived connection is used to support the introduction of potentially inappropriate interventions for older adults, or to contribute to a technocentric vision of ageing, it is important to correct it.

The reasons for the failure of the research to demonstrate such a connection can be summarised as follows:

Training/ support effect

High levels of contact between participants and teachers or supporting volunteers make it impossible to attribute changes in well-being specifically to computer and internet use. It is at least as likely that well-being changes are attributable to increased face-to-face social contact. Indeed, where the two factors are separated (Billipp, 2001; White et al., 1999) improvements in well-being are explicitly associated with training and support and not with computer use.

Mis-attribution of causality

Research that shows a relationship exists between two characteristics, e.g. network connectivity and life stress (Wright, 2000), does not indicate anything about the direction of the relationship: that is, whether network connectivity decreases life stress, or life stress decreases network connectivity.

The exception to this is where measures are taken before and after an intervention (e.g. Cody et al., 1999) when it is possible to attribute changes to some aspect of the

intervention. However, in these cases it is important to clarify the direction of the relationship: for example, that more positive attitudes to ageing *predict* continuation in a computer training course, and are not a result of the course.

Inappropriate generalization of results

Results from a self-selected sample group of experienced computer users (e.g. McMellon & Shiffman, 2002; Wright, 2000) should not be generalised to the wider population of older people. Simply because some people have benefited from computer use it does not follow that everyone will benefit: older people are a diverse population.

5.1. Conclusions: what these studies show

It is unfortunate that the body of research reviewed here has been used to justify the rather simplistic assertion that computer use improves well-being for older adults because this is an area in which research is badly needed, and one to which these papers contribute interesting work.

Appropriate training

Several studies demonstrate that some combination of computers and training, often combined with increased social interaction within the housing complex, do have a positive effect on well-being (Billipp, 2001; Cody et al., 1999; McConatha et al., 1994; White et al., 1999). It is arguable that, in terms of improving the well-being of older adults, it would be more useful to investigate the training processes rather than focusing on computer use. Billipp's results indicate that it matters who does the training: this is a finding worthy of further exploration.

Computer use

A positive side-issue for HCI developers that emerges from these studies is that older adults will use computers and, most importantly, that some will learn to use them

sufficiently successfully, and will find them sufficiently useful, to continue using them after the study ends and support is withdrawn. (Namazi and McClintic, 2003).

Participants' wish for a computer in their own homes varies widely, as one might expect. Billipp's (2001) study of 40 "computer illiterate" frail older adults found that 87% of the study participants would not want a computer in their homes after the end of the study; whereas Czaja et al (1993), whose participant group had very positive attitudes towards computer use at the beginning of the study, found that 82% reported that they would miss the computer. It should be noted that neither paper makes it clear what the context of this question was when it was put to the participants.

Support for frailer users

By comparison, a relatively consistent finding in the research is that complete beginners, and especially frail older people, need considerably more support and, within the time constraints of these studies, do not achieve independence in using the computer (Namazi and McClintic, 2003; Straka and Clark, 2000).

Alterations to computer systems

A theme that emerges as a secondary issue from much of the research is that computer systems as they are are not appropriate for use by frail older adults. Namazi and McClintic (2003) summarise many of the problems that participants encountered. They note, "it was clear that many participants were unable to learn and subsequently remember the computer commands or comprehend the inherent functions for the operation of computers" (p.543). See also the suggestions for improvement made by other authors (e.g. Danowski and Sacks, 1980; Saunders, 2004; Sherer, 1997).

Connectivity

There is some evidence that higher levels of social connectivity predict computer use (Cody, 1999) and the continuation of computer use (Straka and Clark, 2000). This result suggests that computers are unlikely to, themselves, act as tools to reduce isolation in vulnerable older adults but rather will act as an additional way for those with existing social networks to stay in touch with them.

6. Final comments

There is a political imperative to close the digital divide and, in most cases, our own prejudices support it. Working with human-computer interaction and older people, we have all encountered older people who benefit tremendously from their computer use. In addition, we are all, quite correctly, anxious to avoid ageist assumptions that older people should not be included in the new information society. As human-computer interaction researchers, the people we tend to encounter are high-functioning volunteers with positive attitudes towards ageing and research, if not always towards computer use. The most vulnerable older people are harder to access and to work with, but it is this group who are most in danger of having inappropriate technology thrust upon them.

Although there are many reasons to be excited about the potential of technology to support and change society, it is dangerous to assume that the effects will always be positive. As Selwyn et al (2003) note, “much academic and political interest in older adults and technology has been based on an implicit assumption that ICT use is an inherently useful and desirable activity” (p.577). It is important not to let our prejudices influence our objectivity, even if our aims are altruistic. The hypothesis that computer use per se improves well-being among older adults needs to be tested properly – and until it has been tested we need to remain cautious.

It is worth asking, indeed, whether it is currently *possible* to test the hypothesis that computer use improves well-being for older adults. Computer systems as they are now demand considerable knowledge to set up and use; are accessible to the disabled only if the user has, or is supported by someone who has, the technical knowledge to find and

use assistive technologies or accessibility options. As the studies discussed in this paper have shown, frail older adults are unlikely to attain autonomy using computer systems and will usually depend on support from others to help them achieve relatively basic tasks. Given this situation it will be difficult to evaluate properly the effect of computer use in isolation from personal contact with the trainer.

To attempt to remove the effects of training from the examination of the results of computer use, it would be important either to compare computer use with a similar activity which necessitated a comparable level of training, or to have no training, which would only be possible if systems were developed which could be used autonomously by older participants. This second alternative is ultimately likely to be a more realistic option, and in addition it has possible benefits for older users themselves: the ability to use a system autonomously, without dependence on others, may well make the potential benefits of computers use more accessible.

However, we should not overlook the centrality of personal contact to well-being: research on self-defined quality of life among older adults consistently indicates the centrality of personal contact (Gabriel and Bowling, 2004; Wilhelmson et al., 2005). It is possible that systems that allow autonomous use will have the effect of isolating people and making them feel more lonely. There is some evidence to suggest that family visits to nursing homes can be detrimental to the well-being of the resident (Nussbaum, 1990) and this should lead us to be especially cautious: what if communicating with them through the computer simply demonstrates to you how far away from your family you are?

It may be that appropriately designed computer systems will have a positive effect on well-being, but it is important to recognize that the effects could also be negative, and to approach this research carefully and objectively. There is an interesting scientific question to be explored, but, more importantly, we have a responsibility to ensure that technologies are not inappropriately introduced based on insufficient evidence of their worth. It is vital, as we have shown, to ensure that conclusions drawn from the literature are really supported by the research.

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Study	Method	Support	Conclusions
<p>Billipp, 2001</p> <p>The study took place in 1993.</p>	<p>Four groups of elderly, computer-illiterate community-living clients (n=40). Measures: self-esteem (Rosenberg Self-Esteem Scale), depression (Geriatric Depression Scale), attitudes to computers and attitudes of the nurses. One control group without computers. 3 months.</p>	<p>Computer training provided (a) in one initial session; (b) by a friend or relative; (c) by a trainer nurse. All groups had weekly visits from nurses.</p>	<p>Interactive computer use alone had no effect on any of the measures. A combination of training and computer use brought change in self-esteem and, for the nurse trainer group only, a reduction in depression. 87% of clients did not want a computer in their homes.</p>
<p>Cody <i>et al.</i>, 1999</p>	<p>292 participants enrolled on a 4 month WebTV training program. 48% dropped out. Measured: computer anxiety, computer efficacy, attitudes to aging & social support. Use of computers recorded through "adventure sheets" which participants filled in themselves.</p>	<p>Weekly lessons with trainer, encouraged to work with other learners.</p>	<p>Higher computer efficacy, lower computer anxiety, positive attitudes toward aging, higher perceived social support and higher connectivity were predictors of staying with the program to the end.</p> <p>Staying with the program had no effect on attitudes to ageing or computer efficacy, but did improve social support, computer anxiety and connectivity.</p>
<p>Danowski & Sacks, 1980</p>	<p>Semi-formal design with 30 pre-test and 13 post-test responses. 6 item questionnaires. 3 weeks.</p>	<p>Weekly formal presentations on human-computer interaction. Weekly newsletter. Trained demonstrator provided support.</p>	<p>Significant changes in answers to questions "Do you think using the computer would make you more confident in yourself" and "Do you think using the computer would make you feel less alone?" as well as computer attitude improvements.</p>
<p>McConatha <i>et al.</i>, 1994</p>	<p>14 long-term care residents. Measures: activities of daily living (modified Katz index), depression (Geriatric Depression Scale), cognitive function (Mini-Mental State instrument). 6 months</p>	<p>Graduate assistant, trained staff members, and client volunteers working in a "buddy" system.</p>	<p>Significant results: increased ADL, decreased depression, increased cognitive ability.</p> <p>Their main conclusion is that computer use can be a tool to re-integrate people into a larger community.</p>

Straka and Clark, 2000	84 participants. 6 months of weekly access to a computer.	9 hours of teaching. Continual support from volunteers. Computers used in pairs.	Follow up with qualitative results indicating benefits for some participants.
White <i>et al.</i> , 1999	15 people finished the study. Control group (n=8) Measures: Affect Balance Scale; UCLA Loneliness Scale; CES-Depression Scale; Duke Social Support Index. 5 months.	9 hours of training. Intervention group: 3 individual interviews at baseline, 2 weeks (after training) and 5 months. Control: interviews at baseline and 5 months. One part time RA and 5 volunteers provided support throughout study. Help desk staffed by students available. 2 newsletters & one meeting. Participants encouraged to work together on the computers.	After 2 weeks (the training period) intervention group significant decrease in loneliness compared to baseline. However, after 5 months no significant results found.
White <i>et al.</i> , 2002	Randomized trial with 39 of 51 initial participants completing training and follow up interview. Control group: (n=45). Measures: UCLA Loneliness Scale; CES-Depression Scale; Perceived Control of Life Situations; Computer Attitude. 20 weeks.	9 hours of computer training in classes of 4-6. Trainer available for 2 hours a week and by email/ phone for the rest of the study.	No statistically significant results. After 5 months 60% of the intervention group were still using the Internet weekly.
Wright, 2000	Online questionnaire answered by SeniorNet members (n=136). Average age=62. Comparing Internet relationships with non-Internet relationships.	N/A	People who spent more time online communicating with online network were more satisfied with it.
Selected additional literature			
Blit-Cohen & Litwin, 2004	20 participants; 10 computer users and 10 non-users.	N/A	Computer users had more positive attitudes to ageing.
Czaja <i>et al.</i> , 1993	36 independently-living women. Communication system.	Lab-based training, ongoing support. Introduction to other participants.	Well-being measures not reported; participants positive towards computers.

<p>Namazi & McClintic, 2003</p>	<p>Qualitative study of effect of computers in long-term care. 24 people started, reduced to 5. Clients varied in computer experience. 15 months.</p>	<p>Author, student and volunteers.</p>	<p>Anecdotal report that clients preferred computer classes to other organised activities. Computers too difficult to use and discouraged the beginners. Many complete beginners had difficulty becoming independent computer users.</p>
<p>Sherer, 1997</p>	<p>33 residents of nursing home and day care centre. Expt group (n=19) and control group (n=14). Measures included computer attitude scale. 6 months.</p>	<p>Five volunteers. 3 residents in steering group. Staff also helped.</p>	<p>Attitudes towards computers improved, but did so equally in experimental and control groups.</p>

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