

Older pedestrians, mobile phones and new way-finding technology: first stage of new research

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C.McCreddie. Older pedestrians, mobile phones and new way-finding technology: first stage of new research. Gerontechnology 2005; 4(1): 5-14. **Problem** New developments are currently occurring in mobile phone technology that involve harnessing GPS (Global Positioning Systems) to provide Location Based Services (LBS). This article reports on the first stage of research that aims to develop this technology in ways that will potentially benefit older people and people with visual impairments. **Methods** The literature on older people's use of mobile phones is briefly reviewed. This stage of the research involved in-depth semi-structured interviews with 32 older people, mainly aged 80 and over. The interviews included questions about respondents' use of mobile phones and their views and ideas about technology to assist in pedestrian way-finding. **Results** Just under a third of respondents, the majority of them male, used a mobile phone. Overall respondents divided more or less equally on whether they thought way-finding technology would be useful to them. However, the majority of respondents were able to come up with ideas about the content, transmission and design of any such technology. **Discussion** Among these respondents, chronological age was a poor indicator of interest in and use of mobile phone technology for way-finding. Our results support other research that emphasises the diversity of older people and the variety of factors that drive people's use of technology. **Conclusion** While the use of mobile phones for way-finding has potential for older people, their engagement in practice with the technology will depend on a complex of social factors, of which chronological age may be the least important.

Keywords: older people, mobile phones, way-finding, location based services

Although the first mobile telephone service was introduced to the public in the USA in 1946, mobile phone usage has increased significantly in the last ten years. By May 2003, 75% of adults in the United Kingdom owned or used a mobile phone. Older people are less likely to own a mobile phone than younger age groups, although this is a crude generalisation (see below). In 2003, nearly 90% of those aged 15-34 owned or used a mobile phone in the United

Kingdom compared with less than 25% of those aged 75 and over. However, interestingly, between 2001 and 2003, the largest increases in mobile phone ownership occurred in the older age groups, and the proportion of those aged 75 and over using a mobile phone increased from 13% to 24%¹.

The latest mobile phone technology has developed from a convergence between the personal computer and the mobile

phone. New mobile networks have much larger capacity and the new technology has the capacity to 'individualise' the service it offers and respond to user needs. In particular, there is a growth of 'location based services' on mobile phones. The Global Positioning System (GPS) is used to determine an individual's geographic location and the Geographic Information System (GIS) is able to provide mapping information. This can be augmented by information about, for example, the nearest cafe, or bank, or point of cultural interest. The system will then guide the phone user to the place of their choice. The Location Based Services for All (LBS4all) project aims to develop applications of this new technology in ways that will potentially benefit older pedestrians and people with visual impairments. The research has been designed to make the involvement of older people a central focus. It uses an iterative methodology to consult, try out, consult again, and refine the product before arriving at a solution. This article reports on the first iteration with users. In this first stage, a sample of older people were asked about travel on foot, way-finding, use of mobile phones, and their views on the innovative technology and aspects of its design. The article focuses on the older people's use of mobile phones and their views, whether they were mobile users or not, about the content and design of the way-finding technology.

LBS4all builds on previous research by team members at City University, notably the WebPark project which provided personalised relevant information to mobile users within recreational areas² and the Mobility of Blind and Elderly People Interacting with Computers (MOBIC) project³. MOBIC involved the development of a navigation aid for blind pedestrians, which provided them with detailed route information both for planning and in the course of carrying out

their journey. At the Institute of Gerontology, King's College London, earlier work on a hand-held way-finding device⁴ and on mobility needs of older people^{5,6} contributed substantial experience of user-centred and iterative methodologies. Research closely related to the present project is being undertaken at the Universities of Glasgow and Dundee as part of the UTOPIA project⁷.

OLDER PEOPLE AND MOBILE PHONE TECHNOLOGY

The engagement of older people with innovative technology is increasingly a salient topic of research. As is well known, both the numbers and proportions of older people have increased sharply in all countries⁸. In Great Britain in April 2001, the time of the most recent national census, there were an estimated 14 million people aged 65–84 and a further 1.9 million aged 85 and over⁹. Sixteen million people spanning two generations clearly embrace a huge range of ability, income, capacity, interests, and life-experience. This diversity in the older population is particularly important in relation to the adoption of a new technology like the mobile phone. Older people have traditionally been generalised about and viewed as a dependent group^{10,11} who may be slow to adopt new technologies. Differences in educational background, and most importantly differences in income, may be at least as important as differences in health and sensory and mental capacity related to aging when considering the adoption of new technologies. Mann et al.¹¹ in the United States found that mobile phone ownership was strongly related to income. Puro¹² in Finland found that *"the difference between young and old is much smaller than might be expected...people over 60 who live alone are the only group that so far manage without mobile phones"*. Katz and Aakhus¹³ have pointed to the connection between mobile phone penetra-

tion rate and cost per minute of using a mobile phone. As part of this research, we analysed ownership of both fixed and mobile phones in Great Britain by both age and income with the results as shown in Table 1.

There is a pronounced income trend in relation to telephone ownership, with those in the highest income groups most likely to own both a fixed and a mobile telephone at all ages. People in the lower income groups, when they are older, are much more likely to own a fixed telephone only, compared with their contemporaries in higher income groups. The difference between age groups in the highest income groups between those owning both fixed and mobile phones is not very great except for those aged 80 and over. Younger people in the lower income groups are more likely to own only a mobile telephone: this is very unusual among older people. Some research suggests that the use made by older people of their

mobile phones is different to that of younger people. Data from a survey in the United States of subscribers and non-subscribers aged 18+ showed that older people used their mobile phone much less than younger age groups and were more likely to keep their mobile phones for emergency use¹⁴.

Various features of mobile phone design have been criticised by older people. These include the size of the keyboard and the buttons, difficulty in reading text from the screen, their dependence on good hearing, and the fact that they cannot be used with a hearing aid¹⁵. Older users have emphasised the importance of simplicity in design and of proper technical back-up and support if the technology goes wrong¹⁶. Japanese research, reported at a conference in 1998¹⁷ indicated that older consumers rated the following four principles as the most important in design terms: simple and straightforward with minimum functions; safe; easy to clean;

Table 1. Ownership of type of telephone by age and household income. Great Britain 2002. Source: General Household Survey, 2002-3. Own tabulation, unweighted. The total in each age group is the base of the percentages in columns 3-6. The missing percentages (so that the column percentages for each age group total 100%) are those referring to respondents having only a mobile phone, and respondents having no phone. The total sample size is 7591, representing 88.1% of households in the General Household Survey. 11.9% of households did not provide income data

Age of household reference person	Telephone type	Gross weekly household income			Total %
		≤ £300	£300 - £450	≥ £450	
		% of income group within age			
16-49 n=3777	Fixed only	15.4	11.4	6.0	9.3
	Fixed and mobile	58.2	76.4	90.0	79.6
50-59 n=1375	Fixed only	31.4	21.8	8.9	16.8
	Fixed and mobile	55.5	76.7	89.5	78.5
60-69 n=1054	Fixed only	44.5	28.4	12.7	32.4
	Fixed and mobile	51.0	70.7	86.3	64.9
70-79 n=897	Fixed only	62.3	39.3	18.3	53.8
	Fixed and mobile	34.8	59.0	80.7	43.7
80+ n=488	Fixed only	82.0	60.4	41.0	76.6
	Fixed and mobile	15.0	39.6	59.0	20.9

light and compact. Older people place a high value on personal safety¹⁸ and may see this as a potentially important benefit of owning a mobile phone¹¹, but it can equally be seen as a risk¹⁹.

AIMS OF RESEARCH

This paper addresses the first stage of the LBS4all project. Prior to any technical development, the research aimed to assess the experiences, needs and preferences of a sample of older people about finding their way to places and their use of mobile phones. The second aim was to assess their views about using a mobile phone to find their way and about the information content and design features that they considered would be most useful to them in pedestrian journeys outside the home. A further objective was to obtain a wide spread of views, rather than aim at a representative sample of experience. Further components of the user study involved a literature review and secondary data analysis to place the interviews in context.

METHODOLOGY

Study setting and sample selection

The sample was recruited from three organisations in the south of England. They included a voluntary organisation providing activities for people aged 50 and over, a provider of sheltered housing (both owned leasehold and rented) and a local club in inner London providing a weekly programme of outings for their 250 members. The aim was to recruit nine respondents from each organisation. The criteria for inclusion were: (i) aged 80 or over, **or** (ii) aged 70 or over, **and** using **either** a) a walking stick or other walking aid **or** b) with some visual impairment. Details of the sample and response are shown in Table 2.

Respondents were recruited as follows. The voluntary organisation invited the researcher to a lunch club for people aged 60 and over, helped draft a leaflet and helped distribute it to members of the lunch club. Six people volunteered, one of whom did not meet the inclusion criteria. The organiser then introduced the researcher to four more respond-

Table 2. Sample and response of interview respondents by organisation

Organisation	Number approached	Response	Number interviewed
Voluntary organisation	Leaflet given out to approximately 25 members attending local Lunch Club on 28.11.03. and 4.2.04. + personal invitation to 4 members not attending the lunch club	6 (24%) + 4 (100%)	9 (included one couple)
Housing Association	Site managers in three areas approached residents who met the inclusion criteria and who had moved into their accommodation within the last two years	11	11 (included one couple)
Local members Club	Letter to all 250 members included with monthly newsletter	11 (4.4%) + 1 neighbour recruited by respondent	12 (included one couple)

ents who met the inclusion criteria. The central office of the housing association contacted three of their site managers and asked them to select residents who met the inclusion criteria plus the added requirement of having moved within the last two years. The local Club included a letter of invitation, explaining the research and the inclusion criteria, to all their 250 members with their monthly newsletter. The researcher also attended the Club's Annual General Meeting and outlined the research briefly there. As a result, eleven people volunteered to be interviewed and one respondent recruited her neighbour to the research. All respondents met the inclusion criteria.

The interviews

In total, the author conducted 29 eligible in-depth interviews which were tape-recorded, and mostly held, at the respondent's request, in their own homes. The semi-structured interview schedule covered the following areas:

- i Levels/patterns of independent travel on foot;
- ii Satisfaction/problems with independent travel in both familiar and unfamiliar environments;
- iii Ways in which people inform themselves about way-finding;
- iv Usefulness of maps;
- v Use of mobile phone, personal computer, head-phones;
- vi Experience of GPS in cars;
- vii Views on situations in which way-finding information might be useful and the kinds of information it might be useful to have;
- viii Views on how this would best be communicated and any other relevant design features;
- ix Respondents' health and socio-economic characteristics.

Data analysis

The data on respondent characteristics

was coded and analysed and the interview scripts were transcribed in full and analysed.

FINDINGS

Note, all names are fictional and respondents' own words are in italics.

Respondents' characteristics

The 32 respondents included three couples who were interviewed together. Twenty six (82%) were aged over 80, and nineteen (59%) were women. Twenty (62%) lived on their own and the remainder, including the three couples, with their spouse. Twelve respondents were car owners. Respondents were very likely to report a long term health problem - 27 (84%) reported a condition such as arthritis, heart conditions, diabetes, asthma, long term disability, blood pressure, mental health problems, osteoporosis, and so on. Usually they were successfully taking medication to alleviate the effects of the condition. Fourteen (44%) saw themselves as having been 'in good health' in the past year and a further 11 (34%) as in 'fairly good health'. All respondents were able to go out on their own. In terms of walking aids, one respondent was permanently in a wheelchair, four used shopping trolleys as a walking aid, one used crutches and seven used a walking stick. Eleven respondents had some visual impairment. Seven said they had a mild problem, such as not being able to read the number of a bus approaching. Four respondents were registered blind, three of whom used white canes.

Ownership and use of mobile phones

Ten respondents, of whom seven were men, out of 32 owned a mobile phone. Fifty per cent of the six respondents aged 70-79 had a mobile compared with 27 per cent of those aged 80 and over. There was an implied positive relation with income in that mobile owners were

more likely to own their own house (39% compared with 11%) and to be car owners (75% compared with 5%). There was no clear relationship between owning a mobile phone and self-reported health, hearing or sight problems. Mobile phone owners were less likely to use a mobility aid than those who did not own a mobile phone.

Overall seven out of ten did not use a mobility aid and only one used a walking stick. Among the non-mobile owners, six (27 per cent) used a walking stick and a further four some other kind of mobility aid. Eight out of ten owners of mobile phones actually used it. One man used his as an alarm clock and one woman had put hers in the garage. Six users (five men, one woman) used their mobile less than once a week. One respondent, aged 82, had owned a mobile for about three years, but only used it about three times. The majority did not keep their phone switched on and the two respondents who had their mobile switched on all the time were women. In general, respondents held an instrumental attitude to mobile phones, namely it is best used for a particular purpose. For example, a husband (aged 80) used the mobile to let his wife know that he was on his way home from somewhere. In marked contrast to this, one of the female respondents (aged 85) kept her mobile on all the time and used it on a regular basis for sending text messages.

In terms of the design of their mobile phones, the three regular users did not report difficulties with the key pad, although one found it easier to take the mobile out of its holder as the tingling in her hands made it more difficult to press the keys and she had to use her thumbs. One male respondent, aged 83, who kept his mobile for emergencies, particularly when going out in the car, thought that the keys should be larger for older people, he found it easy to

press two keys simultaneously. He, and the other occasional users, also found it rather difficult to see the keys.

Among those who did not have a mobile phone, a number were quite positive about the idea of a mobile phone, and two respondents, both women and over 80, specifically said they would like one. There were a number of reasons why others did not want a mobile phone. Two respondents did not want their 'space invaded'. A blind respondent said he would not be able to see a mobile properly, and one respondent used to work for British Telecom and thought it would be disloyal if she got a mobile. Finally, people did not want a mobile because they saw no need for it.

Views about the use of mobile phones for way-finding

All respondents were asked for their views on using a mobile telephone to help them find their way. Not surprisingly, seven out of ten mobile users were enthusiastic about the innovation. The most enthusiastic respondent was in his early seventies, registered blind and travelling a good deal to unfamiliar locations. He envisaged that the innovation would benefit him very considerably. However, among those who did not own a mobile phone, nine (40%) were also enthusiastic. Some thought that the technology might be useful for someone else, even if not for themselves, or specifically in an unfamiliar environment. Sixteen respondents were not interested. These respondents expressed a range of views. Three respondents thought that there were better ways of spending money, and one couple could not see that it would be useful to them since they relied on their daughter for everything. The most common reason expressed was the same one identified above - these older people did not feel they had a need for this particular technology. This was well

expressed by Mrs Buxton (83) who said: *"Well I think its perfectly splendid when you have no other means, but I can't really see the point in it (laughing) I'm not likely to stray into the Sahara Desert"*.

Ideas for way-finding information

However, even those who were not interested in the innovation were mostly able to come up with ideas about the kinds of information that might be helpful. This was of three kinds: directional information, 'obstacle avoidance' information, and location based services. In terms of directional information - how to get from where you are now to where you want to go to, the main kinds of information referred to were distance, slope (are you going up hill or down hill or on the flat?), and numbering of shops and houses. In terms of obstacles, stairs and steps were most frequently mentioned (including for the blind respondents the length of the flight and whether they go up or down), whether there was a ramp or a handrail and for blind respondents, pavement furniture like lamp-posts and litter bins, as well as temporary obstacles like parked cars or overhanging awnings. The general aim needs to be a reduction in the unpredictable aspects of moving around. The five location based services that respondents would find it most useful to know about were:

- i. Toilets, including their state, which were male and which female (a blind respondent) and distance to the nearest toilet.
- ii. Transport information: location of bus stations, railway stations, bus stops, particularly location of bus stops when travelling on a bus, bus information (which bus goes where). Bus information was of particular interest to the respondents living in inner London.
- iii Places of cultural and historical interest.
- iv House and shop numbers.

v Steps and stairs, and whether they are up or down, and if there are handrails.

In addition, the following services were all mentioned by a smaller number of respondents: Local walks and parks and gardens; health services e.g. doctor's surgery, hospital; post offices and banks; shops and department stores; restaurants, cafes and where to find 'a nice cup of tea'; police station; public services: e.g. tax office, Council offices, Tourist office, or information office; entertainment and sporting locations; special facilities for older people e.g. lunch clubs, drop in centres.

Mrs Haverfield, aged 85, the respondent who used a mobile most frequently, was very interested and envisaged the development of the technology as follows: *"Well yes, I suppose it would be (helpful) ...you would have to...like have a sort of chart, sort of in a way like the Post Office is A, the hospital's B, the doctor's surgery is C, and if that could be a memory bank, you see, so that all of a sudden...you might want to tell somebody where the post office is (A) and it would give the information"*. Another woman respondent, also 85, wanted to know whether the user would be able to ask questions and thought that it would be useful if colour were used to flag up particular landmarks.

Transmission of information

Among those who expressed a view, there was a preference for seeing rather than hearing, although some respondents preferred the idea of hearing. Respondents repeatedly stressed the importance of clear information with a number mentioning the importance of a very clear keypad, of font size and style and of colour contrast to aid legibility. In general, respondents thought that the larger the size of the keypad the better. There were two main reasons for the preference for visual rather than aural information. First, a number of re-

spondents had hearing problems and some used hearing aids. Some concern was expressed about being able to see and hear while in the street with traffic going by and about the compatibility of the device with a hearing aid. Second, there was some fear that audio-based information might not be repeatable, so that if you missed it, you lost it, whereas you could carry on looking at a screen. This concern also emerged in the Glasgow research⁷.

Design issues

Ease of use was a particularly important concern of respondents. Three further issues were raised: cost, safety, and portability. The only wheelchair user in the sample flagged up the need for it to be appropriate for people like himself in wheelchairs. Safety issues were of considerable concern to him. Mrs Harper, who was not keen on the idea anyway, thought that in her area, anyone using such a device would be at very high risk from muggers. Mrs Haverfield, although very positive about the innovation, raised the same point: *"If its in your bag and you get it snatched, your phone's gone. Mind you, if it's in your pocket, they knock you down and it's gone as well. Wherever it is on you, it's gone. Well I suppose it's best to carry it where you're most familiar with it, because you can't absolutely avoid everything happening to you. When I take my trolley, it (the mobile) is in my trolley"*. People wanted the device to be large enough for them to be able to see the information clearly, but they also wanted to be able to carry it easily in a pocket or handbag.

DISCUSSION

Gitlin²⁰ has suggested that the contribution of social science to technology is to consider how best a technological strategy can enhance the well-being of a population that is characterised by its diversity in needs, cultural preferences,

and access to technology. The first stage of our research demonstrates the relevance of these perspectives. Even among this comparatively small sample, respondents' health, sight, hearing, affluence, interests, family, and social circumstances were very variable. People were differentiated further by the extent to which they were more or less determined, active, sociable, out-going and 'gadget-minded'. They witnessed to the truism that chronological age is a poor indicator of likely attitudes to and use of technology. One of the older, and less physically able respondents, was the most enthusiastic user of mobile phone technology. Her comments, and those of other respondents, suggested the importance of family in helping some people to become familiar and confident about using their mobile phone. As we have suggested elsewhere²¹, 'felt need' is an important driver of engagement with technology. Respondents who were negative about the idea tended to see it as irrelevant to their particular needs. Where, however, there are cost considerations, income may be a key influence on attitude.

It is important also to distinguish age and cohort effects. Table 1 showed how mobile phone ownership varies as much by income as it does by age group. But it also shows the almost universal ownership of mobile phones in the younger age group and the switch to mobile phones from fixed phones, which has been a marked trend in Finland^{12,22}. This may lead to increased use of mobile phones by older people in the future, as present younger cohorts age. However, as Lachoee and Anderson²³ emphasise in an important contribution to the research, life-stage "fundamentally affects (people's) need to communicate, whom they need to communicate with, when and to what end. Thus an understanding of how these needs vary, and how technologies can be designed to meet

them is critical". They argue that it is not possible to predict accurately the use that people will make of a technology because of the diversity of factors relating to the social context of telephone use – clearly evinced in our small study – and the way these change. Lacohee and Anderson²³ found that all users were very cost conscious about using the telephone and this, and the earlier research quoted¹³ suggest that cost will be an important influence on mobile phone use.

CONCLUSIONS

Way-finding by means of GPS systems is a new development in mobile phone technology. It offers exciting opportunities for older people, provided their needs are taken into account. Despite their diversity, our respondents concurred on the need for design to address some of the more common physical, sensory, and cognitive problems that people increasingly experience as they age – namely screen legibility, clear audibility, the availability of repeat functions and, most of all, a general need for simplicity of operation. However, as Lacohee and Anderson²³ point out, social factors such as 'gender, role, market positioning, pricing, life rhythms, lifestyles, location of use...aesthetics and social networks' will be at least as, if not more, important in determining the acceptability of the technology to older people. We hope that our research can throw some light on this broader social context of one component of mobile phone use. In the next stage of our research, six older volunteers will be trying out a first version of the technology with detailed mapping information and guidance on points of interest in an area of West London.

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References

1. National Statistics Online. Adult mobile phone ownership or use: by age, 2001 and 2003: Social Trends 34
www.statistics.gov.uk Accessed 12/11/04
2. Krug K, Mountain D, Phan D. Location-based services for mobile users in protected areas. *Geoinformatics* 2003;6(2):26-29
3. Petrie H, Johnson V, Strothotte T, Raab A, Rainer M, Reichert L, Schalt A. MOBIC: an aid to increase the independent mobility of blind travellers. *The British Journal of Visual Impairment* 1997;15(2):63-66
4. McCreadie C, Tinker A, Turner-Smith, A. Way-finding: report to Engineering and Physical Sciences Research Council 1999 unpublished. London: Age Concern, Institute of Gerontology, King's College
5. McCreadie C, Seale J, Tinker A, Turner-Smith A. Older people and mobility in the home: in search of useful assistive

- technologies. *British Journal of Occupational Therapy* 2002;65(2):54-60
6. Seale J, McCreddie C, Turner-Smith A, Tinker A. Older people as partners in assistive technology research: the use of focus groups in the design process. *Technology and Disability* 2002;14:21-29
 7. Goodman J, Gray P, Khammampad K, Brewster S. Using Landmarks to support older people in Navigation. www.dcs.gla.ac.uk/~joy/research Accessed 23/06/04
 8. Butler RN, Muller C. The elderly in society: an international perspective. In: Tallis RC and Fillit HM, editors. *Brocklehurst's Textbook of Geriatric Medicine and Gerontology*. 6th edition. Edinburgh: Churchill Livingstone;2003;pp1413-1422
 9. National Statistics Online. Focus on older people: population 2004. Available at www.statistics.gov.uk Accessed 14/5/04
 10. Tinker A, Older people in modern society. 4th edition. London: Longman 1997
 11. Mann WC, Helal S, Davenport RD, Justiss MD, Tomita MR, Kemp, BJ. Use of cell phones by elders with impairments: overall appraisal, satisfaction and suggestions. *Technology and Disability* 2004;16:49-57
 12. Puro, J-P. Finland: a mobile culture. In: Katz JE, Aakhus MA, editors. *Perpetual contact: mobile communication, private talk, public performance*. Cambridge: Cambridge University Press;2001;pp19-29
 13. Katz JE, Aakhus MA, editors. *Perpetual contact: mobile communication, private talk, public performance*. Cambridge: Cambridge University Press;2001
 14. Baker CA, Jackson AMCL, Understanding consumer use of wireless telephone service: executive summary. American Association of Retired Persons. Washington: Public Policy Institute, AARP;2000
http://research.aarp.org/consume/d1732_8_wireless_1.html Accessed 8/9/03
 15. Dewsbury G, Clarke K, Hughes J, Rouncefield M, Sommerville I. Growing older digitally: designing technology for older people. INCLUDE 2003 proceedings, 25-28 March 2003. CD Rom: ISBN 1 874175 94 2. London: Helen Hamlyn Research Centre, Royal College of Art;pp246-251 Available at: www.gdewsbury.ukideas.com/INCLUDE_2003_GROWING_OLDER.PDF Accessed 1/04/05
 16. Zeilig H, editor. Telephones, alarms and other telecommunications for older people. Report on Cost 219 conference, 17 June 1998, London: University of London, Age Concern Institute of Gerontology, King's College;1998;pp1-12
 17. Jones G. Mobility and Sensory Problems. In: Zeilig H, editor. Telephones, alarms and other telecommunications for older people. Report on Cost 219 conference, 17 June 1998, University of London, Age Concern Institute of Gerontology;1998;pp1-12
 18. Philipson C, Bernard M, Phillips J, Ogg J. The family and community life of older people. London: Routledge;2001
 19. Cheverst K., Clarke K., Dewsbury GJ., Fitton D, Hemmings T, Rouncefield M. When geography matters – location awareness and community care;2002; www.gdewsbury.ukideas.com Accessed 01/12/03
 20. Gitlin LN, The role of social science in understanding technology use among older adults. In: Ory MG, DeFreise GH, editors. *Self-care in later life: research, program and policy issues*. Springer Publishing Company; 1998;pp142-169
 21. McCreddie C., Tinker A. The acceptability of Assistive Technology to older people. *Ageing and Society* 2005;25:91-110
 22. Kuusela V, Vikki K . Change of telephone coverage due to mobile phones 2001 www.jpsm.umd.edu/icsn/papers/kuusela_vikki.htm Accessed 30/03/01
 23. Lachoshee H, Anderson B. Interacting with the telephone. *International Journal of Human-Computer Studies* 2001;54:665-699