

A cognitive prosthesis and communication support for people with dementia

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Running title

Cognitive prosthesis and communication

THE POTENTIAL OF THE COMPUTER AS A COGNITIVE PROSTHESIS

The potential of computers to augment human intellect has long been noted (Engelbart 1963). The term 'cognitive prosthesis' has been applied to this relationship along with a useful description of how this might operate in practice (Kirsh, Levine, Fallon-Krueger & Jarros, 1987). A cognitive prosthesis should provide a compensatory strategy for people with an impairment in cognitive processing which, when added to the user's environment, increases their ability to function effectively. Cole and his colleagues have devised such compensatory systems for people with acquired cognitive impairments, and they emphasise the need for highly personalisable systems (Cole 1999). It has been speculated that advances in technology could eventually allow a cognitive prosthesis system to act as a 'companion' for a person with cognitive impairments, helping them by monitoring their activities and offering appropriate prompts and advice (Vanderheiden 1990).

One area in which the cognitive prosthesis approach has been taken is in assisting non-speaking people to communicate. It is necessary for the systems developed in this field to operate at the level of cognitive prostheses if realistic rates of communication are to be achieved (Alm, Waller & Newell 1996). Here the potential for computers to act as a kind of scaffolding to support communication and other cognitive tasks is beginning to be realised. Arnott points out that in this regard it will be important to draw clear boundaries between the person and the computer so that the person is ultimately in overall control, even if the computer is performing cognitive tasks on their behalf (Arnott 1990).

Computers do therefore seem to have the potential to support cognitive tasks, taking over functions that have been affected by illness, accident, or ageing. Computers might also provide prompts for daily living, if they were able to track successfully the user's sequence of tasks and actions. One problem of growing prominence to which this could be usefully applied is in supplying support for elderly people with dementia and their carers. We have been working with this idea in a number of exploratory projects, building on our previous work in helping non-speaking people to communicate through computer-based systems.

SUPPORTING COMMUNICATION BY PHYSICALLY IMPAIRED NON-SPEAKING PEOPLE

People who are unable to speak due to physical impairment have benefited greatly from the development of computer-generated communication support, particularly in addressing the problem of rate of speech production. Current speech output technology limits severely physically impaired non-speaking people to speak at a much slower rate, typically 2-10 words per minute, compared with the 150-200 words per minute common in unimpaired speech. In an attempt to improve this, computers have been used to augment or even replace some of the cognitive aspects of communication. Based on theories generated to explain the cognitive processes underlying communication, one useful approach derives from the pragmatics of language use. Although the complexities of communication are incompletely understood, the functionality of communication systems for non-speaking people can be

effectively improved. Focusing on the pragmatic use of language, that is, language as it is used in context, brings a 'top-down' approach to communication, away from the more traditional 'bottom-up' approach, which emphasises the word-by-word building blocks that utterances comprise. This may well be a realistic simulation of the natural process, since the production of speech by an unimpaired speaker occurs at such a rate that conscious processing and controlling of the speech at a micro-level is not possible. In common with other learned skills, speech is produced to some extent, automatically, with the speaker being aware of giving high-level instructions to the speech production system, but leaving the details of its implementation to the system (Higginbotham & Wilkins, 1999).

A number of projects have investigated the utility of focusing on pragmatics in increasing speech output rate. By using pre-stored conversational material, the communication rate can be substantially increased. For instance, the CHAT prototype (Alm, Arnott & Newell, 1992) gave the user the ability to move easily through the more formulaic stages of daily interactions, such as openings, closings, and giving feedback to other speakers. Another system, TALK, experimented with modeling the way in which topic shifting occurs in a step-wise fashion during a casual conversation (Alm, Todman, Elder & Newell, 1993). Work has also been carried out investigating the usefulness of providing 'scripts' (Dye, Alm, Arnott, Harper & Morrison, 1998) and 'frames' (Higginbotham, Moulton, Leshner, Wilkins, & Cornish, 2000) for use in common everyday situations.

What unites these projects is the provision of a partial model of communication to the user. This model basically comprises a structure within which reusable utterances are stored. Because the structure closely follows the way a natural conversation proceeds, utterances are made available to the user in a timely and appropriate way. Given such a structure in order to make it easier for users to have the right utterance at the right time, it is clear that the same structure could act as a 'prompt' for communication, as well as being a passive store of useful utterances. The desirability of prompting conversational directions is the topic of hot debate, given that the overall intention of computer assistance is to improve the individual's control of conversation. Because the amount of conversational control possible at 2-10 words per minute is severely restricted, this argument seems to be a matter of judgement about trade-offs. It is relevant to note, however, that opportunism is a feature of a great deal of casual conversation in any case.

One attempt to examine the benefit and desirability of prompting looked at people with acquired aphasia (Waller, Dennis, Cairns, Brodie, Newell & Morrison, 1995). Here the participants' communication difficulties were compounded by problems in the cognitive processes that support communication, thus emphasising the cognitive prosthesis role of the computer. The system contained stored personal narratives, entered by the person with aphasia with the help of family members. Once entered, the narratives could be called up by the person and spoken out sentence by sentence, to facilitate interaction sessions. These sessions were enjoyed both by the person using the system and their conversation partners. This provision of prompts for communication, using a model of communication as interaction, has potential application to the progressive cognitive and communication difficulties faced by people with dementia.

THE CHALLENGE OF DEMENTIA

As the proportion of the elderly population in many countries is increasing sharply, the number of older people who have dementia or other difficulties and are in need of support in their daily life will correspondingly increase. The numbers of people in the UK over the age of 65 are predicted to increase from 9.25 million in 1996 to 12 million in 2021. The number of people aged over 75 will have doubled and the number over 90 will have more than tripled. The USA Census Bureau states that the chances of having a disability increases with age, and shows that more than half of the population who are 65 or over have a disability (U.S. Bureau of the Census, 1995). A significant proportion of these disabilities are cognitive in nature. Currently, it is estimated worldwide that after the age of 65 there is a steep increase in the incidence of dementia, rising to nearly one in four of those over 85 (Jorm, Korten & Henderson, 1987). These rates of dementia have significant social and economic implications for the affected individuals themselves, their families and for the wider community. In addition, living with dementia poses a range of practical, physical and psychological problems that require support for both the person with dementia and their caregivers. Basic activities of daily living, as well as communication and a range of cognitive abilities can all be affected. Consequently quality of life and well being of both people with dementia and their carers are adversely affected. Creative solutions will be required to meet the significant challenge of coping with dementia.

Of all of the realms affected by dementia, arguably the most significant impact is on communication (Azuma & Bayles, 1997). Given the impairment of short-term memory common in dementia, holding and maintaining conversations becomes progressively difficult. Many social activities and interactions become increasingly difficult, as they depend on a working short-term memory for effective participation. As such, people with dementia can become socially isolated and deprived of the range and variety of social interactions that characterise everyday life for unimpaired people. Finding ways to promote communication in people with dementia is therefore vitally important for a number of reasons. First, communication is such a fundamental part of being human that when people are no longer able to communicate successfully they are treated as somehow less than human. This ‘dehumanisation’ is, sadly, commonly seen in the treatment of people with dementia (Kittwood, 1990). Second, caring for someone with dementia can be frustrating and upsetting. When communication fails, carers are left to infer intention and meaning from behaviour and this can have negative consequences, such as believing incorrectly that someone is deliberately being difficult. Third, there is a progressive and uneven breakdown in communicative abilities in dementia. Thus the apparent loss of some abilities does not mean a person can no longer communicate altogether. Consequently, interventions must be targeted at the relatively intact functions (Astell & Harley, 1998, 2002; Azuma & Bayles, 1997; Rau, 1993).

REMINISCENCE AS A COMMUNICATION SUPPORT

Short-term memory impairments in dementia make various aspects of conversation very difficult and frustrating for the conversation partner. However, activities that do not require the person with dementia to keep a conversation topic active can provide a satisfying and interesting interaction for both parties. The provision of such positive interactions, at whatever level they are understood by people with dementia, can be considered as successful interventions (Woods, 1994). In addition, they can improve the relationship between carers and people with dementia, which is an appropriate aim in dementia care (Jackson, 1991). To do this successfully, two conditions must be met. First, it is important to discover ways of continuing to interact with the person with dementia that provide carers with a picture of the whole person and not just a set of needs. Second, methods of interaction must give the person with dementia a chance to experience satisfying communication.

One technique that has proved effective for both the person with dementia and caregivers is reminiscence work (Baines, Saxby & Ehlert, 1987; Finnema, Dröes, Ribb & Van Tilburg, 1999). Reminiscence takes advantage of the fact that long-term memory may be relatively intact, even where a person's short-term memory is severely affected. Reminiscence sessions are typically carried out by creating a scrapbook of photos and other memorabilia, and may incorporate audio and videotapes. These materials act not only as a memory aid, but also as a support to communication. They partly replace the person's own lost abilities to deal with immediate memories (such as what they said five minutes ago), while encouraging them to employ their still effective long-term memory (such as what happened forty years ago).

Reminiscence is of course a natural and valuable form of interaction for older people in general. It can give them 'a dignity, a sense of purpose, in going back over their lives and passing on valuable information to a younger generation' (Thompson, 1978). In addition, 'reminiscence [may serve] ... a variety of goals, including increased communication and socialisation, and providing pleasure and entertainment' (Woods, 1999). As well as being valuable to older people in general, reminiscence can act to empower older people who have dementia (Feil, 1993; Sheridan, 1992). Thus, reminiscence provides not only a tool to stimulate interaction, but also a contribution to improved quality of life for the person with dementia and their family. Indeed the 'main impact' of reminiscence may be the positive effect it has on general communication (Woods, 1994).

POSSIBILITIES FOR MULTIMEDIA

Recent work using videos to present life histories for people with dementia suggests that new technologies, where sensitively and appropriately applied, can add substantially to supportive and therapeutic activities (Cohen 2000). Multimedia systems have the potential to provide a richness of interaction that is particularly appropriate for those elderly people with diminishing sensory and intellectual capabilities. There is potential for the communication of people with severely diminished short-term memory to benefit significantly through computer-aided reminiscence.

A reminiscence experience based on a computer, using multimedia techniques, may provide a livelier and more engaging activity for people who struggle with spontaneous interactions. This has the potential to enhance the communication support typically associated with reminiscence activities and build on them. Reminiscence sessions traditionally make use of a variety of separate media. It can be very time-consuming searching for a particular photograph, music, sound or film clip. Bringing all of these media together into a multimedia system could mean a more integrated framework for a reminiscence session

and save valuable time. Multimedia technology affords the seamless inclusion of text, photographs, graphics, sound and film recordings, and also the ability to link the various items together in a dynamic and flexible way. ‘The key question is how can this technology be harnessed to facilitate learning and human endeavour?’ (Preece, 1993). Effective design is the answer if the potential benefits of multimedia are to be reaped.

Valuable experience has been gained from the success of a ‘hypermedia’ (information link) structure in establishing the popularity of the World Wide Web on the Internet. The user is invited to interact with the material presented in a more lively way than by just looking at text and pictures on a page. Interestingly, the highly flexible and multidimensional nature of hypermedia, which has been cited as a potential navigation problem for users, may in fact be of benefit for people with memory loss, in that it does not put any penalty on 'losing the place' (Alm et al., 1990; Conklin, 1987; Maddy & Brouwer-Janse, 1996; McKerlie & Preece, 1992; Peiris, Gregor & Alm, 2000). Whatever place the user is in is the right place to be. Exploring and 'getting lost' are actively encouraged as strategies to enjoy experiencing the material. The design challenge for a multimedia system that could act as a communication support is to make the interface engaging while at the same time prompting conversation away from the screen. The idea is for the user to be prompted into talking about something relevant to their own experience, and when they are finished, to help them quickly locate another topic which they would like to talk about. In this way, the multimedia display should act as far as possible as a kind of adjunct visual and auditory memory for the person with cognitive difficulties.

Pilot studies

Work has been carried out through a number of projects at Dundee University to test the feasibility and effectiveness of such multimedia reminiscence system and communication support. It is essential that such a system is easy to operate by both carers and people with dementia. It is also important that the experience offered is one that can be enjoyed without relying on short-term memory.

1. Interactive games

A number of computer-based games have been developed to address a range of issues pertinent to the development of a computer-based reminiscence and conversation aid. First, is to investigate different ways of interacting with a computer system. Second is to explore ways of engaging the attention of people with dementia. Third is to examine ways of providing entertainment for people with dementia. These games have been developed in consultation with people with dementia and their carers, and were evaluated by them. The games took as their starting point a board game for people with dementia to enjoy with their families and friends. The game has no competitive element, nor finishing point, and does not rely on memory for successful play (Cohen, 2000). We developed two prototype computer-based games with similar features. They invited the user to press a button on the touch screen, which then activated an animation sequence and music. This sequence ended in the production of a graphic and some text, which was designed to elicit comments from the user. In use, these simple computer games demonstrated the effectiveness of touch screens with people who were not familiar with computers, including people with dementia. The games proved to be engaging, and were enjoyed by people with dementia.

2. Personal web pages

In order to explore ways of presenting and organising reminiscence material for a multimedia system, a project was carried out with a group of healthy older people at a community centre who were interested in learning about computers. The project had two aims. First to evaluate the suitability of a specially developed tool for the purpose of constructing a personal reminiscence website. Second, to investigate the acceptability of this technology to a group of older people. The tool was designed for older people to use to create a personal reminiscence website, based on both their own and publicly available material. In order to elicit personal material easily, the system used a combination of pre-stored material and material supplied by the user, including newspaper cuttings, recipes, graphics and text.

The material was assembled with the help of a structured dialogue with the user that incorporated computer-interviewing techniques. These provided an interactive question and answer session that evoked memories whilst allowing users the freedom to answer in their own words. The person's own material was then combined with the prestored material, and automatically compiled for them into an attractive and easy to navigate website. We concluded that presenting a tool specifically designed for older people, and one that they have a good motivation for using, can help older people with few computing skills to learn to use the new technology. As well as participating in an enjoyable reminiscence session older people were learning about computers and the World Wide Web. Creating a personal page brought about a sense of achievement in coming to terms with new technology.

This project was helpful for two reasons. First, it explored ways to help older people to use technology easily, and in a way that they found rewarding and relevant. Second, it was also an investigation of the use of multimedia to present reminiscence material in an engaging and interesting way. A process of iterative design was used, with continuous feedback from users on a series of prototypes they were shown.

3. Reminiscence scrapbook

A pilot study was then undertaken to determine which aspects of multimedia would be most useful for a reminiscence experience specifically for people with dementia, and the best way to present this material. A number of prototype interfaces for a multimedia reminiscence experience were developed. These included text, photographs, videos and songs from the past life of Dundee. The materials were collected with the assistance of Dundee University and Dundee City archives and library, and the Dundee Heritage Project. The prototypes were demonstrated for people with dementia and staff at a day centre run by Alzheimers Scotland Action on Dementia. The following questions were posed and conclusions drawn from these evaluation sessions:

1. Is it better for the display to use the metaphor of a real-life scrapbook or just provide very simple screen display?

Staff members tended to prefer the simulated scrapbook presentation. However, the preference of the people who had dementia was for the simpler screen presentation. This could be due to reduced cognitive ability whereby the simulated book presentation may be giving the person with dementia more information to process than they are comfortable with. They would first have to see the book and recognise it as such before moving on to seeing the picture.

2. How should the scrapbook material best be organised – by subject or by medium?

The majority of the staff evaluators preferred the arrangement by subject saying it was more logical, some were unsure, but no one showed a preference for the arrangement by media. The clients with dementia echoed these views. Despite preferring the arrangement being by subject the majority of evaluators could see benefits from having access to both arrangements. It was concluded that for basic reminiscence sessions the arrangement by subject is preferable. However, access to the arrangement by media should be an option, to make the software available for use in other ways.

3. How does each individual medium add to the reminiscence process, and what effects are produced by the various media – sounds, pictures, videos, music?

It was found that with videos the clients were only able to strongly identify with them when they triggered off specific personal memories, whereas songs and photographs were more generally appreciated. Overall, most of the videos and photographs and all the songs were able to spur conversations however. Attention stayed longest with the songs, which were particularly enjoyed when played repeatedly with everyone singing along. The staff on the other hand felt that some individual clients enjoyed particular videos most. The topic of the video clip is clearly an important determinant of how much it is enjoyed but it is too early to say what topics should be focused on.

One general finding was that the multimedia presentation produced a great deal of interest and motivation from the people with dementia. Staff were also very keen to see the idea developed further. These preliminary studies highlighted the need for a more thorough exploration of ways in which this technology can act as an effective support for satisfying conversation for people with dementia. Our current project is taking a multidisciplinary approach to addressing this issue by developing a fully functioning multimedia reminiscence experience and communication support.

A MULTIDISCIPLINARY PROJECT TO DEVELOP A REMINISCENCE SYSTEM AS A COGNITIVE AND COMMUNICATION AID

We feel it is important to take a multidisciplinary approach in order to make the multimedia reminiscence system as engaging and effective as possible. From our previous work it is apparent that such a system will need to have sophisticated and reliable software, an engaging and well-designed presentation of the media, and be based on sound psychological and social principles that underlie interactions. The development of the architecture, navigational methods, and content of the reminiscence experience, along with the collation and digitalisation of an extensive audio/visual archive of material presents a demanding design and development challenge. The researchers in this project, from St Andrews University, Dundee University (Applied Computing and Duncan of Jordanstone College of Art and Design), are drawn from the fields of computer aided design, applied computing, and the psychology of dementia. A professional graphic designer using a multimedia design package is devising the interface and visual look of the system. A software developer with human-computer interaction expertise is carrying out the design and coding of the system structure and navigation methods, designing and building the multimedia database and developing the authoring system. A psychologist is responsible for providing design guidance throughout the development of the system, for creating and maintaining links with potential users and clinical professionals, for giving feedback on the system design as it progresses, and for carrying out the formal evaluations. Dundee Social Work Department and Alzheimer Scotland Action on Dementia also provide design and content advice.

We have carried out pilot work in the day-care settings into current practice in reminiscence, looking at what works best and how such sessions might be improved by a multimedia system. The findings suggest that emphasis should be placed on failure-free reminiscence activities and that these should be as relevant as possible to the individual. Contacts with managers and other staff members of both Alzheimer Scotland and Dundee Social Work Department are being maintained and 'link' members of staff have been identified. A group of about 40 people with dementia have been contacted to take part in evaluating the material as it is produced. A further 25 carers and family members are also taking part as sources of ideas for the system and as evaluators of it. A number of sample themes and content items that the system might include have been developed and evaluated by this group.

The identification of appropriate software and hardware has been made: a professional multimedia presentation system accessing a multimedia database and outputting through the largest commercially available LCD touch-panel display. Photographic data, film footage (both archive and contemporary), local folk songs, sounds and music, are being identified and collected. A structure for the multimedia database has been devised. Flexible scripting in the programming will ensure that the process of involvement need not be repetitive - each use of the material will be a different experience if desired, while an index or search facility will allow for more predictable options.

The iterative design process has seen the creation of a prototype system, incorporating material from sound, video and photographic archives. This initial presentation package has been demonstrated to representatives of Alzheimer Scotland and Dundee Social Work Department. We have also carried out a pilot study into the acceptability of the system to people with dementia and their carers.

Pilot study of the acceptability and accessibility of the prototype multimedia system

The aim of this pilot study was to gauge immediate reaction to the system and identify any immediate problems in using it.

PARTICIPANTS

Three men and three women with dementia and six carers took part. Three of the people with dementia were seen at home with their family carer and the other three were seen in day care with a member of care staff. The mean age of the people with dementia was 74.3 (range 57-95) and severity of dementia, as measured by the Mini Mental State Examination (MMSE, Folstein, Folstein & McHugh, 1975) was an average of 15.6 (range 10-25).

MATERIALS

Assessment was made using a structured interview and, for carers, a self-report questionnaire with a Lickert scale for responding.

RESULTS

In the interviews all participants said that they enjoyed using the system and none identified anything they did not like. When asked what they found particularly good, care staff noted the choice of material available and the effectiveness of prompting clients to speak more than usual. Family carers particularly liked the video clips and the easiness of the system to use. They all found the touch screen easy to use but there were requests for greater onscreen contrasts. One carer suggested having the option to increase text and photograph size and there was some support for having supplementary text available to facilitate discussion. It was suggested that a pause button would be useful and also to have better control over volume. From the self-report questionnaires it was established that the colours were pleasant and the text size about right. The on-screen touch buttons were usable with practice and the system as a whole easy to operate. Useful feedback was gained about video and song clip length and picture size.

Prototype evaluation

Based on these findings, an more detailed evaluation study of the system in practice was carried out. The main aim was to make a close study of the system in use by people with dementia and carers. Their interactions were recorded and all participants were asked to evaluate the session at the end. The evaluation was to address the following considerations:

- (a) The effect on maintaining the interest and involvement of the person with dementia
- (b) The impact on carers' enjoyment in keeping company with the person with dementia

PARTICIPANTS

Nine people with dementia were recruited, four male and four female, with a mean age of 83 years (range 65-95). Severity of dementia was measured using the MMSE, giving a mean MMSE 16 (range 8-22). Nine care staff at five day centres were also recruited. The care staff were paired with people with dementia to participate in the multimedia reminiscence sessions.

MATERIALS

A prototype multimedia reminiscence package presented on a 20" LCD touch screen. The package contained three categories: entertainment, recreation and local Dundee life. Media for each category included photographs, video clips, songs and music. Navigation around the system was by touch screen menus. The MMSE was carried out with all participants with dementia. Two evaluation questionnaires were designed for the multimedia package, one for use with care staff and one for participants with dementia.

PROCEDURE

Participants with dementia were paired with a member of care staff for each session. The MMSE was carried out with the participants with dementia at the start of each session. A demonstration screen provided instructions on how to use the multimedia package. Each pair of people with dementia and care staff spent 20 minutes using the computer. At the end of each 20-minute session, each person with dementia completed the evaluation questionnaire. Following this, each member of care staff completed the evaluation questionnaire.

RESULTS

Evaluation of the multimedia reminiscence system by people with dementia

All participants said that they enjoyed the multimedia reminiscence session. When asked to expand on what they liked best, a range of replies were elicited (Table 1). Of these, the last comment reflected one participant's view that the photographs were not glamorised, but actually depicted the way things used to be, in this case in the jute mills of Dundee.

Picture of the bathing house
Football
Music (2)
Dundee life
Judy garland
Pictures
The fact that the items are 'true to life'

Table 1. The parts people with dementia liked best in the multimedia reminiscence

Participants were asked if there was anything that they did not like about the multimedia system. All but one said 'no', but when questioned further the one dissenting individual was unable to supply any further information. However, a number of general comments were elicited of direct relevance for revising the system and making it more used. These included comments on the size of the typeface, the brightness of the visual images, the size of the screen and the selection of stimuli available.

When the participants with dementia were asked if there was anything else they would like to see in the system, there was a clear desire for items of personal relevance (Table 2).

A picture of the participant's mother
A picture of the participant
A picture of the participant's local football team
A picture of where the participant used to live

Table 2. Items that participants with dementia suggested should be in the multimedia reminiscence system

All of the participants with dementia had no difficulty adapting to and using the touch screen. When encouraged by their care staff partner, all people with dementia used the touch screen. They all said that they would like to use the system again in the future with two people spontaneously commenting during sessions that they were enjoying using the system.

Evaluation of the multimedia reminiscence system by care staff

All of the care staff said that they enjoyed the multimedia session and that they believed the person with dementia did too. When asked to identify what they particularly liked and what they thought the person with dementia most enjoyed, a range of responses were elicited (Table 3). These relate to both the usability of the system and the response of the clients to the system.

Carers	People with dementia
Photographs of Dundee	Singing
Old songs	Using touch screen
The fact that the system is easy to use	Talking about memories
Client's reaction	Music
Client's interest in using the system	All of it

Table 3. Parts of the multimedia system care staff liked best and thought that people with dementia liked

All of the care staff felt that the session was worthwhile both for them as carers and for the people with dementia. When asked to explain why, the responses echoed those above, relating the success of the sessions to ease of use of the system and the reactions of the clients (Table 4).

For carers	For people with dementia
Using technology and being able to use the system	Relating to things the client liked in the past
Finding out about things that were previously unknown about the client's history	Client remembering younger life – remembered a lot
Having more subjects to talk about	Looking at the different items
Seeing the client's reaction to the multimedia	Bringing back memories
Interesting to find out more about the client	Focus of attention on the client
Getting a chance to spend one-to-one time	Helps client to remember
	Gives client a chance to talk about what they want
	One-to-one time
	Chance for client to reminisce about their family

Table 4. Reasons that care staff gave for finding the multimedia reminiscence session worthwhile

For future development of the multimedia system, the care staff reported that they would like to see more variety available. One person also suggested that personal items be included. Overall, the feedback from the care staff about the sessions they participated in was very positive. One reported the belief that the multimedia system is beneficial both to people with dementia and carers, as it is a learning experience for both. Another suggested that the effect seems to be the same as normal reminiscence, just another way of doing it. And another reported not only enjoying using the multimedia system but also being glad to be part of the project.

DISCUSSION

These findings make a case for the use of computers to promote and maintain conversation with people with dementia. The results of the evaluation show that people with dementia can happily adapt to the technology and quickly become comfortable using it. We have shown that a multimedia reminiscence system can assist people with dementia to talk about a wide range of topics. One positive benefit of the wide range of material available is that care staff can use the system with little or no background preparation. This is very important in care settings where staff time is constantly called on. Currently, preparing for a half hour chat with a person with moderate dementia, can seem like a huge chore and often therefore does not happen. However, being able to sit down and interact with someone spontaneously would be a great boon to both staff and people with dementia. Additional benefit also accrues for both parties from spending one-to-one time. One consequence for staff is increased enjoyment not only in participating in the multimedia reminiscence sessions but in spending time with the person with dementia in general. The quality of the time spent together is clearly influenced by the perceived burden of maintaining conversation that falls on staff and the multimedia system appears to alleviate this, allowing for a positive, shared interactive experience where both parties are more equal participants.

NEXT STEPS

We still have many questions to answer in the development of a multimedia reminiscence and conversation support for people with dementia. The next stage will be to compare the effectiveness of the prototype with traditional reminiscence. This will enable us firstly to identify the critical features of reminiscence to supporting conversation and the aspects of the interaction that pertain purely from being in a one-to-one situation. Secondly, and more importantly, we aim to separate the features that make the multimedia system different and we hope better, than traditional reminiscence.

Subsequently we aim to address the following questions:

- (1) Determining what value will be added to a reminiscence experience by providing multi-media capabilities.
 - (a) Its effectiveness in facilitating reminiscence experiences as a group activity;
 - (b) Exploring its use as both as an experience in which the session is guided by a participating carer or family member, and, potentially, as a standalone system to be enjoyed by the person with dementia on their own.

- (2) Determining the optimum way to present the experience:
 - (a) Configurable by carer, family member
 - (b) Random pathways through the material chosen by the system
 - (c) Using hypermedia links as opposed to sequential links

- (3) A study of the effect of incorporating personal material into the general collection.

Effects to be examined are

 - (a) Degree of interest shown by the person with dementia
 - (b) Degree of interest shown by the carer or family member
 - (c) Quality of the experience in terms of
 - (i) Amount of personal reminiscences it triggers
 - (ii) Views of the experience by the person with dementia and the carer or family member

CONCLUSION

The realisation of computers as cognitive prostheses and communication supports for people with dementia will depend on good multidisciplinary co-operation, encompassing not only the software structures needed, but also good design, and a grounding in the psychological and social realities of the situation that people with dementia find themselves in. We feel a good starting point for communication support is to exploit intact long-term memories through providing prompts and stimulation for reminiscence conversations. The work we have done on this approach so far has demonstrated that computer-based multimedia systems do seem to have the ability to engage the attention and interest of

people with dementia. They are usually able to make use of touch screens to control what happens with the interface. What now needs further exploration is just what features of such an experience will work well, and what features are to be avoided, where the aim is to provide a cognitive and communicational prosthesis that supports and stimulates conversation in a way that enriches the interaction between people with dementia and others who want to maintain contact with them.

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