

## Chapter 16

### **User involvement in the design of a new multimedia communication service**

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#### **16.1 Introduction**

As human beings, more than two thirds of our conversation is spent in socialising, gossip and story telling (Dunbar 1996, Dunbar 1997). Transactional or functional conversation quickly moves on to social interaction, and we constantly recount anecdotes to reinforce a practical point we are making or to reinforce our validity to have an opinion on a subject.

Emler (1994) found that human beings spend more than 80% of waking time in the company of other people. Even when engaged in vocational tasks, people still talk to each other. The vast majority of interpersonal interaction is between people who know each other personally. Only around 7% is either between strangers, or is a business or service transaction. When Emler considered more specifically the content of conversation, he found that around 16% is concerned with exchange of facts and transactional interactions, 10% is concerned with sharing emotions, and the remaining 74% is concerned with discussing, principally as anecdotes and stories, past, present and future activities and opinions about these events, focussing largely on people and places known personally.

Read and Miller (1995) also make the point strongly that humans are social creatures. We learn from others and we share with others what we have learnt. We interact with others in various ways that influence our status and roles in social communities.

Read and Miller's work builds on that of Schank (1990) who explored many aspects of story telling, considering it central to social interactions. Scott (1995), in reviewing the work of Schank and Abelson (1995), makes the point that story telling does not automatically imply the use of words. Other forms of representation are possible, for example using pictures or images, symbols, objects or even mathematical equations.

Csikszentmihalyi and Rochberg-Halton (1981) reported that photographs are the third most treasured possessions in the home of a modern western family after furniture and visual arts. When this is broken down by age, they were ranked

sixteenth by children and teenagers, and ranked first by grandparents. The personal value of images was found by Mäkelä et al (2000) to be in socialising and social interactions, and in recording memories. In fact, this study qualified the work of Csikszentmihalyi & Rochberg-Halton (1981), by showing that younger people tended to use images to capture humorous situations or everyday objects that were important to them. This is contrasted with older people who tend to use them to illustrate memories and to recount them in stories.

The life and the communication needs of people with disabilities is changing. Care in the community as a method of delivering care implies that people will not be living in large residential institutions, but will be living in small groups or families, geographically distributed from other people with disabilities. Isolated people with disabilities, therefore, need to be able to interact with care providers, but more importantly, they need to be able to have social interaction with others, using the same set of Internet services that other members of society employ.

A possible means to reconcile the social interaction needs of people, including the desire to share information in different media, and the potential trend towards possible social isolation, is to employ modern telecommunication services, including services such as videoconferencing.

## 16.2 User Requirements

Given this basic need of human beings to interact socially, and given the changing patterns of community living, there is a need to ensure that new communications services are accessible, in order to promote effective social interaction and to reduce social isolation. One important first step in assessing the user requirements for accessible services, is to determine the nature and scale of the issues involved, ie. to know the users. Sandhu (1997) has investigated the numbers of people within Europe that have impairments that could affect their ability to use telecommunications systems. He concluded that around 10.5 Million people within the European Union population of 373 Million in 1993 (2.8 % of the population) had a speech/language impairment. This figure was expected to rise to 13.8 Million within a population of 379.5 Million by the year 2000.

More detailed analysis of the local population of people with speech communication impairments has been undertaken by Brophy-Arnott et al (1992). This study considered a local region and breaks the population down by the nature of the underlying disorder that causes the speech impairment. In this study, 0.65% of the regional population had a significant communication disorder such that professional speech therapy agencies were involved in seeking to deal with the associated implications of that disorder.

Within that set of people, 47% had communication disorders as a result of a condition that was likely to have caused additional physical or sensory impairments. These causes included cerebral palsy (3%), cerebrovascular accident (7%) and other progressive disorders such as multiple sclerosis, Parkinson's disease and motor neurone disease.

Arnott et al (1990, 1999) state that a cognitive prosthesis is "a system developed to support and augment the cognitive abilities of its user". When the prosthetic function relates to communication, it serves the role of providing Augmentative and Alternative Communication (AAC). The majority of AAC systems are designed to provide the user with the ability to conduct functional or transactional conversations, or for training people towards the use of language. The goal is usually to provide a means by which users can express themselves and their intentions and wishes. Depending on the language ability of the user, the system will provide a more or less comprehensive vocabulary and the means to express ideas according to a more or less complete grammar. This is confirmed by Beukelman and Mirenda (1998a), who report:

*"Most of the research and technical developments in the field of AAC have focussed on strategies for enhancing communication of needs and wants and, to a lesser extent, information transfer. The lack of attention to social closeness reflects both a narrow clinical perspective and the very real difficulties inherent in achieving the goals of social closeness interactions. Nevertheless, from the perspectives of many AAC users and their significant communication partners, this type of interaction may be more important than any other."*

An important parameter in the intervention and provision of an AAC system is the ability of the user to handle the more abstract forms of representation. Millikin (1997b) argues that the use of symbols and abstract representations is fundamental to human communication. The more comprehensive the communication, the more we depend on a decreasing number of abstract symbols, but the more powerful and complex are the rules for combining those symbols to represent the concepts and ideas to be communicated.

The more iconic the symbol type, the more restrictive the word class that it conveys. More iconic symbol types tend to be good at representing nouns, but poor at representing verbs and modifiers. The least iconic symbol types can be combined according to recognised patterns to represent nouns, verbs and modifiers.

The situation is still not completely straightforward, however, as those regularly using a symbol type may learn their meanings, but for an unfamiliar user, the symbol may be ambiguous. For example, a photograph may be a very direct concrete representation of a member of a family, but to someone unfamiliar with the family in question, the concrete message of the picture may be completely lost. This property of the iconicity has been characterised by degrees of transparency. Transparent symbols are ones where the symbol is highly suggestive of the concept that it conveys to an untrained observer, whereas an opaque symbol bears no specific resemblance to the concept being conveyed.

So in the field of AAC, pictures or photographs can serve either the purpose of being a representation of a concept or object, or they can convey much more information than simply the noun that they represent. For the user of an AAC device, therefore, a photograph may help the user recognise the information they wish to convey. For the other communication participants, pictures may add a richness to the concept to be conveyed that would require a whole sequence of symbols of another type to represent.

Augmentative and Alternative Communication (AAC) research and development activities have focussed on the ability to share unique utterances in

conversation. The means to share personal stories that characterise the person's individuality have not received the same amount of attention. Techniques for sharing the multimedia record of these stories have not been provided in any AAC system to date. The research described here, therefore, was to explore a technique for enabling people with impaired speech and language to share personal information, in the form of multimedia items that can be presented as stories. This technique is designed to be part of the solution to the problems faced by these AAC users in successfully interacting socially, both face-to-face and at a distance.

### 16.3 Initial Concept

In order to investigate the issues of multimedia based social interaction, the research team at Dundee began to design a computer-based multimedia service. Discussions with people with disabilities resulted in the broad design concept where communications services such as telephony, video telephony, text telephony and e-mail were provided in an accessible way for non-speaking people. The overall concept was based on the extension of the conventional telephony service with the extra elements such as text-telephony, video-telephony and picture telephony. Asynchronous interaction is made available using electronic mail, taking advantage of the fact that multimedia elements can be added as attachments or embedded within a message.

This overall concept took into account the different needs of both face-to-face communication, and communication using Internet services. Various functional modules could be located at different places using a distributed technical architecture. In this way, a low-power, low-cost portable device could be used to select and present media items retrieved from a remote server, taking into account the assistance provided by the prediction algorithms running on the server.

### 16.4 Prototype Evaluation

Following the initial concept definition phase, a prototype assistive communication service was developed that enabled the project team to investigate the possible usability implementation of an assistive communication system that fitted the broad concept explored above. The specific research question that was formulated was:

*Given that the user interface for a system that allows multimedia items to be retrieved and presented would need to reflect the abilities of the target users, (many of whom have poor manual dexterity as well as speech and language impairments), which aspects of the user interface could or could not be manipulated by non-speaking people, considering that most of the non-speaking people available to evaluate the system also had some physical disabilities?*

### 16.4.1 Prototype Design

The prototype communication service that was developed consisted of a Java Application optimised to run on a Windows PC platform. Information was stored in a SOLID database, either on a UNIX server, or in the same computer as the JAVA client application. Information was held as blocks of text, JPEG picture files, QuickTime movie clips, or QuickTime audio clips. These media items were organised into topics, and stored in the database with links to five associated items within the same topic. The user interface of the JAVA client application is shown in figure 1 below.

The topics could be selected from a list that appeared when the "Change Topic" button was pressed on the user interface. When a topic was selected, five media items were loaded into the upper part of the user interface. When the user clicked on a specific media item, that item was presented in the "Display Panel", and five media items associated with that chosen item were retrieved from the database and placed in the upper portion of the display. A novel feature of this service was that it could be used in a "conference" mode, with two or more communicating parties exchanging information. Selections made on one interface would be displayed on all the interfaces connected in the "conference".

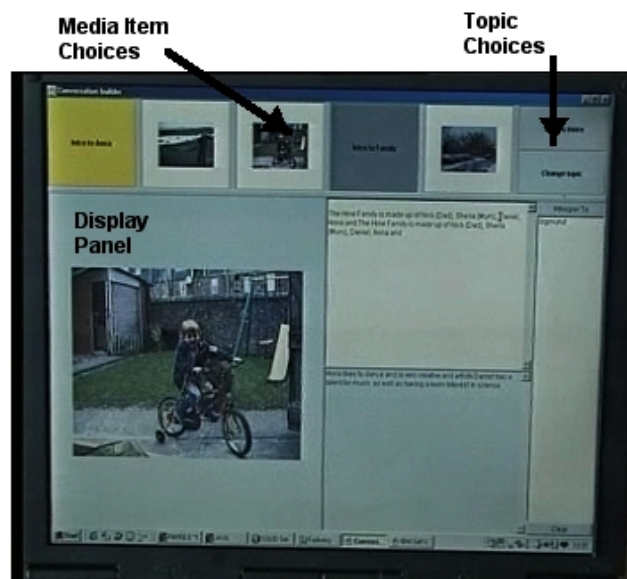


Figure 1. User interface of the initial communication service

### 16.4.2 Evaluation

The purpose of this investigation was to explore with some users with disabilities aspects of the user interface that they found particularly difficult or easy to manipulate.

The user interface of the communication service had been designed and implemented using a broad range of interface elements, including large "button" areas for selection of media items and text based lists for selection of topics. Another element, however, was a narrow selection field presented in the topic lists that did not persist on the screen once the cursor had been moved off it. One topic of interest was therefore to investigate the usability of all the various interface elements, particularly given that people with disabilities often compensate when encountering difficulties by adopting novel, personal strategies. If the participants could make selections from the topic lists, this might allow more powerful interfaces to be implemented on devices with small screens.

Four clients with impaired speech volunteered to try the service. All four participants also had impaired manual dexterity, three as a consequence of cerebral palsy, and one as a consequence of muscular dystrophy. All four used a wheelchair for mobility.

The trial was conducted on a Stylistic 2300 pen tablet computer. A trial was arranged with each participant. A location was found for the computer that allowed them to interact with it, either on their lap, chair or on a desk close to them. The operation of the software was explained and demonstrated to them, and then they were led through a short sequence involving the selection of media items from the set of items available at the head of the display, and the selection of a new topic. The sequence, based on a predetermined script, resulted in a number of short stories being told whilst the users' interactions with the user interface elements were being observed. Two users selected items for presentation using the stylus on the touch screen, the other two used a rollerball pointing device.

The experience with the participants gave these outcomes.

- All the users considered that the service had the potential to be a useful tool for social interaction, and that the focus of the development activity should focus on that aspect of interpersonal communication, rather than transactional communication, or asynchronous communication. In principle, the users wanted to share their stories in a synchronous discussions, and were less interested in asynchronous discussions such as via e-mail.
- In all cases selections of media items from the array of five items at the head of the display could be accomplished. More difficulty was encountered when the selection method involved smaller elements and non-persistent lists.

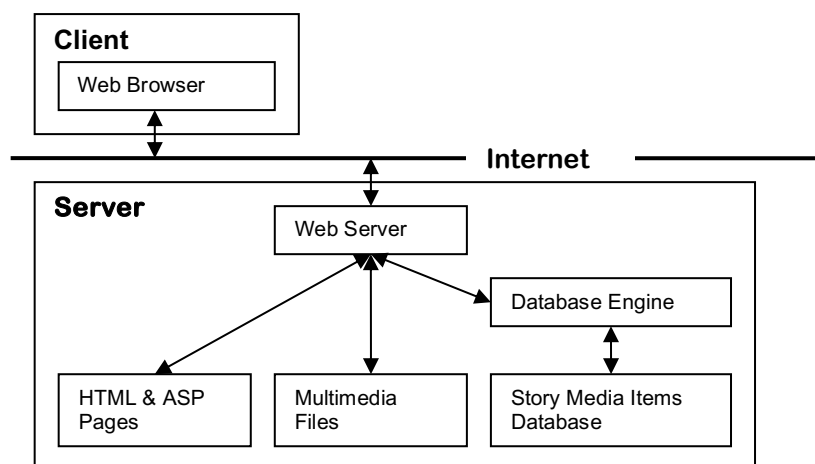
As far as these users are representative of a significant proportion of non-speaking people, the practical usability issues raised need to be reflected in subsequent versions of the assistive communication service. In particular, non-persistent user interface elements should be avoided. Where the display of the device is small, less user interface elements should be placed on the display, rather than shrinking the size of the user interface elements.

Following the user interface test, the users expressed an interest in collating their own media items for presentation using a revised system. The users supplied pictures, audio and video clips and these were scanned or recorded into the computer. Each media item was given a short label, and was accompanied by a single phrase or sentence to highlight the aspects of interest in the media item. Because the team involved in this activity (users, carers and research staff) were geographically separated, it was decided to host the media items on web pages on a central server, and for the web pages to be updated as media items, labels or accompanying text became available. This provided a very dynamic environment for collating new material, and involved the users in a very proactive way.

These initial user tests were followed by a discussion with carers and research peers that focussed on a review of the user interface presentation and interaction aspects. The general conclusion from this discussion was a requirement to significantly simplify both the interface and the interaction techniques used.

## 16.5 Communication Service Design

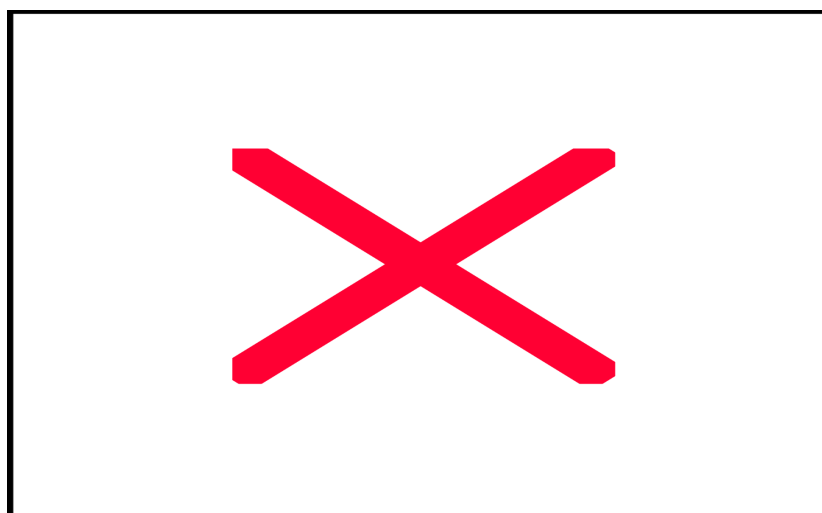
In view of the experience of the users of the prototype communication service, and the experience of collating media items using the web, the service was significantly redesigned. A web-based architecture was adopted based on web pages populated with media items called from a database and presented in a web browser. The client computer and the server may be linked by any Internet Protocol (IP) network, including Wireless LAN. This architecture is shown in figure 2 below.



**Figure 2.** Revised architecture of the multimedia communication service

In the revised user interface, the topic and story selection mechanism has been changed from a drop-down list to a set of top level topics always visible on the interface, leading to a dynamic array of sub-topics, stories, and story media items.

The media items in the client interface refer to the current story, the other stories in the same topic, and the other topics that the user has stories in, as shown in Figure 3 below.



**Figure 3.** Example of the display of the multimedia communication service

The system was populated with media items from two users with impaired speech and with additional motor impairments. The two users were intimately involved in the compilation of the stories within the system, and used the system extensively to verify that the media items reflected the story that they intended to convey. The system was subsequently demonstrated to a group of six non-speaking users and a number of care staff. This demonstration took the form of a workshop where a user presented his stories, and other users who had an interest in the stories commented on the contents and discussed them, using their conventional Augmentative and Alternative Communication (AAC) devices. The workshop was a precursor to an extensive programme of research that has begun to investigate some aspects of the issues that occur when non-speaking people seek to communicate, including the problem of communication breakdown and the aspects of conveying personality attributes during conversations. The validity of the approach as a technique for providing an alternative communication strategy is being explored. Subsequent development of the service will consider the ongoing work in the domains of intelligent and multimedia interfaces (Maybury and Wahlster 1998) and the domains of cognitive science (Friston and Price 2001).

## 16.6 Conclusion

This work has illustrated the key role that users have played in the development of a new multimedia social interaction service. Their requirements have influenced the underlying architecture of the service, resulting in an architecture that enables



both users and carers to be involved in a realistic way in the process of adding and managing multimedia items as elements in stories. The users have also contributed to the presentation of the service, the user interface presentation and construction, and the interaction procedures that govern the use of the system. The service therefore reflects the user requirements in terms of fundamental usability, enabling the issues of usage and suitability of the service to meet the social interaction needs of disabled people to be subsequently explored.

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