

INFORMATION SOCIETY TECHNOLOGIES (IST) PROGRAMME



a Shared Cost RTD project

Project Acronym: WWAAC

Project Full Title: World Wide Augmentative and Alternative
Communication

Contract no.: IST-2000-27518

<i>Deliverable: 2 (Updated)</i> <i>“User Requirements Document”</i>
--

Author:	Mike Clarke, Colette Nicolle* and Dave Poulson*
Organisation:	ACE Centre, * Loughborough University
Date:	22 November 2002
Version:	1.1

Content

EXECUTIVE SUMMARY	4
INTRODUCTION.....	4
USER CENTRED AIMS	4
BACKGROUND	4
METHODS	4
SUMMARY	6
1.0 INTRODUCTION	7
2.0 PEOPLE WITH COMMUNICATION DISABILITIES	8
2.1 CONGENITAL COMMUNICATION DISABILITIES	8
2.2 ACQUIRED COMMUNICATION DISABILITIES.....	8
3.0 BARRIERS TO THE USE OF ASSISTIVE TECHNOLOGY.....	9
3.1 WWAAC PRINCIPLES IN ADAPTATION	10
4.0 DEVELOPMENTS IN WEB ACCESSIBILITY.....	11
4.1 WEB BROWSING METHODS AND TOOLS	11
4.2 FILTER AND TRANSFORMATION TOOLS.....	12
4.3 GUIDELINES FOR DEVELOPING ACCESSIBLE PRODUCTS.....	13
5.0 DEVELOPMENTS IN EMAIL, ECHAT & DISCUSSION GROUP ACCESSIBILITY.....	18
5.1 SUMMARY OF EXISTING EMAIL/ECHAT SOFTWARE FOR SYMBOL USERS	18
5.2 OTHER DEVELOPMENTS INCLUDE	20
6.0 LINGUISTIC SUPPORT FOR SENDERS AND RECIPIENTS OF EMAIL	21
6.1 FACE-TO-FACE INTERACTION.....	21
6.2 COMPUTER MEDIATED COMMUNICATION.....	21
6.3 ELECTRONIC SELVES	22
7.0 SUPPORT FOR LINGUISTIC STRUCTURES.....	23
8.0 WWAAC PROJECT	24
9.0 METHODOLOGY	25
9.1 USER IDENTIFICATION.....	25
9.2 ADDITIONAL STAKEHOLDERS.....	27
9.3 FINAL RECRUITMENT	27
10.0 MEASURES	30
10.1 USER CENTRED METHODS AND TOOLS.....	30
10.2 QUESTIONNAIRE MEASURE (DESCRIPTION OF THE USER PLATFORM).....	30
10.3 INTERVIEW MEASURES.....	30
10.4 OBSERVATION MEASURES.....	33
10.5 SUBJECT MEASURES.....	33
11.0 PROCEDURES	34
11.1 END USER RECRUITMENT	34
11.2 USER INTERVIEWS IN WWAAC	34
11.3 INTERVIEWS WITH MANUFACTURERS & SERVICE PROVIDERS	34
12.0 ANALYSIS.....	35

13.0 FINDINGS.....	36
13.1 INTERVIEWS WITH END USERS.....	36
14.0 QUESTIONNAIRE TO SERVICE PROVIDERS.....	44
14.1 ROLES AND RESPONSIBILITIES	44
14.2 AAC USERS.....	45
14.3 BARRIERS TO AAC USE	50
14.4 MAIN PROBLEMS WHEN USING HIGH-TECH COMMUNICATION DEVICES.....	52
14.5 SERVICE PROVIDERS' EXPERIENCE OF INTERNET SERVICES	54
14.6 SERVICE PROVIDERS' EXPERIENCE WITH EMAIL	55
14.7 SERVICE PROVIDERS' EXPERIENCE WITH ECHAT	55
14.8 SERVICE PROVIDERS' EXPERIENCE WITH DISCUSSION GROUPS.....	56
14.9 CLIENTS' USE OF THE INTERNET	56
14.10 CLIENTS' PROBLEMS IN USING INTERNET-BASED SERVICES.....	57
14.12 USE OF PC ADAPTATIONS.....	59
14.13 LANGUAGE USE.....	59
14.14 BARRIERS TO INTERNET USAGE	61
14.15 FUTURE USE OF SERVICES	62
14.16 FURTHER SERVICES/DEVELOPMENTS NEEDED.....	63
14.17 GUIDELINES TO IMPROVE WWW DESIGN.....	65
14.18 GUIDELINES NEEDED	65
14.19 OTHER WAYS OF IMPROVING ACCESS TO THE INTERNET.....	66
15.0 QUESTIONNAIRE TO MANUFACTURERS.....	67
15.1 PRODUCTS DEVELOPED/DISTRIBUTED.....	67
15.2 MAIN TARGET GROUPS.....	67
15.3 USE OF PRODUCTS	67
15.4 PRODUCTS INVOLVING USE OF WWW OR EMAIL.....	67
15.5 FUTURE DEVELOPMENTS NEEDED.....	67
15.6 PROBLEMS THAT CLIENTS HAVE WHEN USING THEIR PRODUCTS.....	68
15.7 PROMOTION OF SERVICES ON THE WWW	68
15.8 AWARENESS OF GUIDANCE/GUIDELINES TO CREATE WEB PAGES.....	68
15.9 GUIDELINES/GUIDANCE NEED FOR DESIGNING USABLE WWW PAGES	69
15.10 AWARENESS OF STANDARDS USED IN THE DEVELOPMENT OF AAC	69
15.11 DEVELOPMENTS NEEDED IN STANDARDS TO SUPPORT ADVANCEMENTS IN SYMBOL-BASED COMMUNICATION AIDS	69
15.12 THE FUTURE FOR WEB ACCESS.....	69
15.13 THE FUTURE FOR EMAIL	70
15.14 THE FUTURE FOR E-CHAT.....	70
15.15 THE FUTURE FOR DISCUSSION GROUPS.....	70
15.16 ROLE OF MOBILE PHONES OR (PDAs).....	70
16.0 USER REQUIREMENTS SUMMARY	71
REFERENCES	80
APPENDIX 1 EXAMPLE OF A RICH PICTURE DRAWN IN INTERVIEW	83
APPENDIX 2 EXAMPLES OF POWERPOINT REPRESENTATIONS OF INTERVIEW DIMENSIONS	86
APPENDIX 3: INTERVIEW FOR SERVICE PROVIDERS.....	88
PART I: PROFESSIONAL INFORMATION	88
PART II: YOU AND YOUR WORK.....	88
PART III: YOUR CLIENTS	89

PART IV: BARRIERS TO AAC USE.....	90
PART V: YOU AND THE INTERNET	91
PART VI: YOUR CLIENTS AND THE INTERNET	92
PART VII: INTERNET USE IN THE FUTURE.....	93
PART VIII: IMPROVING ACCESS TO THE INTERNET	95
APPENDIX 4: QUESTIONNAIRE FOR MANUFACTURERS	97
APPENDIX 5: LETTER CONCERNING END USER SCREENING CRITERIA.....	101

Executive Summary

This document is an updated version of the User Requirements Document 1.0. Amendments to the original document have been made in response to peer review by the IRIS project. This document describes the state of the art in Internet accessibility and usability at the point at which the task was initiated: month 1. It then describes the methods and findings from an exploration of user requirements. The methodology in user requirements capture is informed by Internal Document i1, which has been incorporated within this report. The findings from the user requirements capture inform the direction of Work Package (WP) 2, WP3, WP5 and WP7.

Introduction

Internet services, such as Web browsing, email and discussion fora are central to many in their work, study and leisure. There is every expectation that use of Internet services, (and related technologies), will expand. The growing emphasis on access to communication and information exchange between individuals and societies, across the globe, presents opportunities and barriers to those with communication disabilities and particularly for people who use graphic symbol based augmentative and alternative communication (AAC) systems. The WWAAC project has a central aim of making Internet services more accessible and usable to people with communication disabilities.

User Centred Aims

To ensure WWAAC developments are accessible and usable by the target population, a user requirements capture was conducted within the user platform.

Background

In order to understand the context in which WWAAC work is being conducted and to inform WWAAC developments, a detailed exploration of state of the art developments in web accessibility, use of email, echat and discussion fora for people with communication disabilities was conducted. No significant developments specifically supporting web browsing for people using AAC systems, and people with dysphasia were identified. Similarly, no significant developments in email / echat / discussion fora for people with dysphasia have been distinguished. A number of developments concerned with supporting email / echat for people using graphic based symbol systems were identified and a critical appraisal of significant features was conducted. Current understanding of the barriers to augmentative and alternative communication system use was documented.

Methods

User identification

The project defined the primary end users of WWAAC to be: People who use graphic symbol-based augmentative and alternative communication (AAC) systems to support/replace speech and/or reading and/or writing, and older people with communication disabilities who may, or may not, be relying on symbol based communication aids, but who would benefit from adapted computer software, to help access Internet services. End users therefore included people with a range of disabilities including physical disabilities such as cerebral palsy (C.P.) with severe dysarthria, elderly people with dysphasia and people with learning difficulties.

By identifying various usage scenarios for Internet access, specified categories of users were identified. The primary target population was identified as school aged children with

congenital disabilities using graphic based AAC systems, and secondly, adults with congenital disabilities using graphic based AAC systems and elderly people with dysphasia.

Additional groups of stakeholders who will benefit from the symbol translation facilities and/or from the web authoring tools developed in the WWAAC project, and whose views can inform user requirement were identified. The following stakeholders were therefore also identified for inclusion in the user requirements capture: (1) software and hardware developers and distributors of high tech AAC, (2) service providers including professional facilitators, including service providers, therapists, teachers, information providers, curriculum developers, family, informal carers.

The central user requirements capture recruited 28 end users, 51 service providers and 10 manufacturers. Of the end users recruited 14 were school aged (age range 12 – 18yrs, median 17yrs), 8 were adults with congenital disabilities (age range 21 – 42yrs median 27yrs), and 6 were older people with dysphasia (age range 40 – 75 years, median age 58 ½ yrs).

Measures

The user requirements primary method of information capture was through the use of detailed one to one interviews and observation. In order to capture requirements of diverse stakeholders, a range of interview tools were developed to include end users service providers and manufacturers.

Summary

User requirements capture prioritised the work of the WWAAC consortium:

- Priority 1: Access to and use of information and services of the World Wide Web
- Priority 2: Use of email between people using the same language (e.g. English to English, Swedish to Swedish and so on.)
- Priority 3: Use of discussion fora
- Priority 4: Use of email between people using the different languages (e.g. between English and Swedish)
- Priority 5: Echat

Specific issues concerning use of www included the following:

- ◆ WWAAC developments should integrate with end users existing computer access systems and techniques e.g. dedicated communication aid, onscreen keyboard emulation/ mouse emulation
- ◆ WWAAC developed interface(s) to access / navigate the WWW should adopt principles of full accessibility for people with physical disability e.g. switch access options
- ◆ Concerning Web Browsing end users reported a desire for easily manageable text to speech output.
- ◆ For end users with physical disabilities, computer accesses was seen to be slow subsequently WWW access potentially very expensive. A priority was identified for exploring strategies to reduce expense in time spent 'on-line'.
- ◆ End users appear likely to share access to computers. Supporting regular and frequent changes between end users on a single machine should be considered
- ◆ Limited attitudes towards, expectations of and enthusiasm for new developments and for Internet Services by those supporting and working with End Users is identified as a barrier to WWAAC – WWAAC needs to explore how to include 'added value' for professional and non-professional people supporting End Users
- ◆ End users will require web pages to be simplified and transformed into usable format for the end user incorporating use of individual symbol systems
- ◆ The project should provide guidelines/tools for making all WWW sites more accessible to End Users
- ◆ The project should provide guidelines / tools for developing WWW sites specifically for symbol users.

Lower priority given to email but many critical issues associated with www overlap with the development of email accessibility and usability.

1.0 Introduction

It is apparent that Internet services, such as email, echat, discussion fora, and Web browsing, are central to many in their work, study, leisure and everyday lives, and there is every expectation that use of Internet services, (and related technologies), will expand. The growing emphasis on access to communication and information exchange between individuals and societies, across the globe, presents opportunities and barriers to those with disabilities.

The World Wide Web Consortium (W3C), (www.w3c.org) has recognised many barriers to accessible Web based information for people with disabilities. Principles for, and promotion of, adaptation of Web based information are embedded within the Web Accessibility Initiative (WAI). Web content developers, therefore, can seek advice and support in design and development of Web based information by reference to Web Content Accessibility Guidelines (WCAG 1.0), User Agent Accessibility Guidelines (UAAG)¹ and Authoring Tools Accessibility Guidelines (ATAG). To date then, these guidelines have sought to address requirements for Web *access* and *usability* for people with sensory disabilities (visual & hearing impairments), motor (physical) disabilities and to a lesser extent cognitive/neurological disabilities. A need for guidelines to incorporate issues of accessibility and usability for people with multiple complex disabilities has been highlighted, and, it is understood that the WAI consortium are working to broaden their support for people with learning disabilities (Brewer and Dardailler 2000). However, to date, there appears little work addressing the functional requirements of people with disabilities in using other Internet based services, such as email, echat, discussion fora. Similarly, as yet, it appears that the needs of people with communication disabilities and those using graphic symbol based modes of communication² have not been addressed fully.

¹ For example: desktop browser, voice browser, mobile phone

² Often, but not exclusively referred to as augmentative and alternative communication (AAC)

2.0 People With Communication Disabilities

2.1 Congenital Communication Disabilities

A significant number of people with congenital physical disabilities (such as Cerebral Palsy), affecting the control of speech musculature (groups of muscles controlling respiration, phonation and articulation), experience difficulty generating speech that is intelligible to others (Aicardi 1998). They may communicate by using natural modes of communication such as gesture, facial expression, signs and so on. Not only do such individuals experience difficulty in face-to-face interaction, they also typically experience difficulty developing literacy skills, (e.g. Topics in Language Disorders 1993, 13, 2). Such individuals may benefit from the introduction of communication aids employing graphic based symbols to augment natural modes of interaction and support literacy (Beukleman and Miranda 1992). The term symbol(s) is usually used to refer to graphic representation of meaning (e.g. pictorial, iconic), other than the written word. Symbol systems and sets (henceforth referred to as systems), may be provided for people with a range of disabilities of varying aetiology, that impact on communication (speech / reading / writing), (Von Tetzchner and Martinsen 2000). Subsequently, such individuals face significant obstacles to accessing text based Internet services.

2.2 Acquired communication disabilities

People with acquired speech and language impairments (dysphasia), caused by insult to the mature or developing brain, such as cerebral vascular accident (CVA) or closed head injury, can experience difficulties in any and all communication modalities. In addition to acquired physical disabilities (hemiplegia for example), such individuals may experience difficulty organising language, articulating speech and regaining competence in literacy (e.g. Howard and Hatfield 1987). Some people with dysphasia may benefit from using graphic symbol based communication systems in conversation and to support literacy. However the prevalence of AAC system use in dysphasic populations is limited (Kraat 1990). Computer based technologies then have been employed typically in the assessment and treatment of dysphasic adults (e.g. Guyard, Masson, Quiniou, 1990). People with dysphasia do experience significant difficulty accessing advanced assistive technologies (Kraat 1990).

Subsequently, these populations experience difficulty with operational aspects of physical access to technology and access to the content of computer based information.

3.0 Barriers To The Use Of Assistive Technology

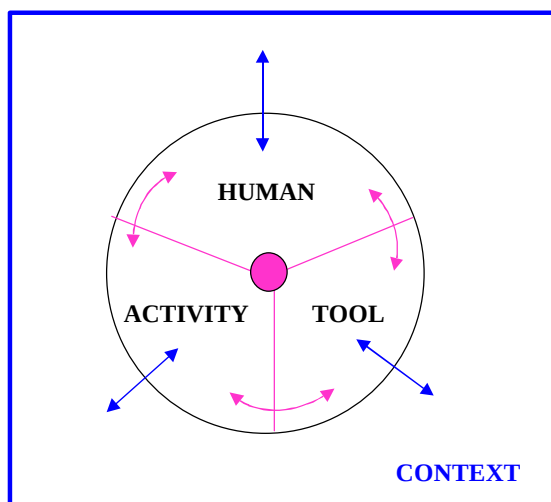
Factors contributing to failure in use of assistive technology and particularly communication aid technology are many and varied. Despite advances in commercially available communication technology, people with communication disabilities comment on continuing difficulty and frustration in making themselves understood, physical access to communication equipment and subsequent reliance on non-disabled partners in supporting communication (e.g. Huer & Lloyd 1990, Murphy, Markova, Collins and Moodie 1996). In a comprehensive study of the communication patterns and experiences of 93 adolescent and young adults using communication aids, Murphy et.al. identified the availability and accessibility of systems, type of vocabulary available, characteristics of the communication partner including their knowledge of assistive technology, and the use of other channels of communication (Murphy, Markova, Collins and Moodie 1996), as significant barriers to the use of communication technology. For older people and those with dysphasia, limited use of symbol based speech output systems has been associated with aspects of user interface, citing small graphic display and confusing or unwanted auditory feedback, lack of speed (Colby cited in Kraat 1990), large and confusing arrays of pre-programmed vocabulary (Enderby cited in Kraat 1990), and limited self confidence and technical competence in computer based technology (Hux 1995), as obstacles to effective use.

For school aged children and young people, operational difficulties, issues of self-image/identity, and lack of perceived benefit in interaction have been identified as factors impacting on the AAC use (Clarke, McConachie, Price and Wood 2000). It is possible that children particularly, may hold views unforeseen by researchers and developers in the field. For instance, children have been documented to prefer more synthetic sounding voices for a computer, whilst adults prefer more natural sounding voice (Mirander, Eicher, Beukelman 1989). It is possible then, that the different cultural populations (culture defined by age and nationality), may hold different and contrasting views of assistive technology.

For any individual, the interaction will be unique, depending on their skills/abilities (e.g. reading or writing), the assistive technology they are using (e.g. their low or high tech AAC system, whether it has speech output, etc.), the activity being carried out (e.g., sending a message or surfing the Web), and the context in which this activity is being carried out (e.g., with family or with the outside world). Difficulties may arise in relation to the interface between any of them, e.g.: between the user and the facilitator, between the user and/or facilitator and the AAC, and finally between the AAC and the outside world (e.g., other people face to face or across the Internet). This interaction can be illustrated by the following model, (see figure 1), which also helped to focus the methodology used in the project to collect users' requirements.

Figure 1: A Functional Model from Cook & Hussey 1995

The model illustrates the interaction between the individual, the tasks they wish to perform and the equipment they need to perform these tasks, and the importance of ensuring that each of these components are matched.



In the field of augmentative and alternative communication, work in support of AAC has been influenced by the model of communicative competence proposed by Janice Light (1989). Light has categorised core skills essential for the development of communicative competence in AAC systems:

- **linguistic** skills - syntactic and referential aspects of communication including learning the meanings of pictures and symbols.
- **operational** skills - technical skills required to operate the communication system. E.g. learning the layout of symbols and symbol accessing techniques.
- **social** skills - knowledge, judgment and skills in social rules of communication.
- **strategic** skills - compensatory skills and strategies to allow effective communication when the limitations of the communication system restrict the user

Whilst professionals and families recognise the need to target support in all four areas, the development of new technologies which aim to benefit people with communication disabilities are likely to focus on ensuring optimal support and accessibility in operational and linguistic domains of use.

3.1 WWAAC Principles In Adaptation

Clearly then, the target population is heterogeneous, with individuals experiencing a wide range of needs including visual and hearing impairments, learning difficulties, difficulties with language and literacy, as well as physical disabilities. Subsequently, principles in adaptation must accommodate, as far as possible these issues. These principles are likely to include:

(1) Simplification

- Easy access to basic functionality
- Removing unnecessary options & barriers
- Support for navigation
- Tailoring for multi-modal support
- Use of sound / synthetic speech
- Use of graphics, symbols, pictures, photos, text

(2) Easy and safe installation, maintenance and support

4.0 Developments In Web Accessibility

The World Wide Web is a complex medium. Despite a recognition that people with physical disabilities can benefit from training in the use of the Internet (wwaacis 1996, www.wwaacis.org.uk), and the benefits of accessible Internet services for all, relatively few developments have considered enhancing Web accessibility for people using graphic based symbols and/or people with dysphasia. Instead, it appears that greater energies have been directed at improving accessibility for those with sensory impairments. The following summarises major Web accessibility initiatives through developments in access to computer technology and access to computer based information:

- (a) browsing methods and tools
- (b) transforming / filtering existing pages
- (c) guidelines for Web design and evaluation tools

4.1 Web browsing methods and tools

4.1.1 Enhanced accessibility options within standard applications

Standard browsing applications do offer enhanced accessibility options (Internet Explorer Accessibility Options, for example). Lynx is a text-only browser that is used by many people who are unable to use graphics-based browsers, such as people with visual impairments using screen readers. Lynx is available for VMS, Unix, Windows 95/98/NT, and DOS (<http://lynx.browser.org/>).

4.1.2 Utilities supporting access to standard applications

Utilities to support access to standard systems / Internet services, for people with physical disabilities employing scanning methods, are available:

- ◆ Switch Access for Windows (SAW), ACE Centre Advisory Trust, as a keyboard emulator, SAW replaces the mouse and keyboard with a series of on-screen Selection Sets - arrangements of letters, words, symbols, numbers and shapes that can be automatically or manually scanned, item by item, and selected using switches.
- ◆ Discover:Switch Don Johnson Special Needs, single switch scanning device for computer access.
- ◆ Multiweb, Deakin University – Specific features include; scanning for switch access, speech output, screen magnification <http://mis.deakin.edu.au/multiweb/MWIntro.htm>
- ◆ Hands off, Sensory Software - Onscreen symbol/picture grids can be configured to carry out browsing tasks, may be accessed by switch scanning methods
- ◆ Clicker, Crick Software Ltd. Onscreen symbol/picture grids can be configured to carry out browsing tasks, may be accessed by switch scanning methods.

A variety of screen reading systems have been developed for people with visual impairment that aim to support navigation using standard applications. Examples of such screen readers include; JAWS for Windows (www.hj.com/main.html), ASAW (www.microtalk.com), HAL (www.dolphinuk.co.uk), Lookout (www.screenreader.co.uk), OutSpoken (www.aagi.com/aagi/aagi_home.html), Simply Talke (www.econointl.com/index.htm), Slimware Window Bridge, Window-Eyes (www.gwmicro.com), and WinVision (www.artitech.com).

Voice-driven navigation is also available, (for example; ConversaWeb, www.speechtechnology.com/otherspeech/conversaweb_n.html), providing voice activation and speech output. Other voice-driven systems appear designed more specifically for telephone based access (webHearit, SpeechHTML and TelWeb, for example).

4.1.3 Alternative Applications

A range of *alternative* approaches to Web browsing, supporting a range of adaptive features, are also currently available. They are primarily focussed on supporting the needs of people with visual impairment and many share common features such as speech output and simplified keyboard interface. For example:

- ◆ BrookesTalk, Oxford Brooks University, UK – this package, still in development for blind and visually impaired users, aims to support *intelligent* Web browsing. Specific features include speech output and screen magnification, text précis www.brookes.ac.uk/schools/cms/research/speech/btalk.htm
- ◆ EIA, Sarsfield Solutions, Australia – designed specifically for people with learning difficulties. Specific features include touch screen and simplified language interface <http://gippsnet.com.au/eiad/browser.htm>
- ◆ EMACSPeak, - a speech-enabled environment for EMACS. Specific features include; speech output, simplified keyboard interface, full web browsing capabilities through WWW. <http://emacspeak.sourceforge.net>
- ◆ HomePage Reader, IBM – a speech based browser using Netscape Navigator. Specific features include speech output, simplified keyboard interface based on the number keypad www-3.ibm.com/able/hpr.html
- ◆ Marco Polo, Sonicon – A plug-in for Netscape Navigator. Specific features include speech output, auditory icons, simplified keyboard interface www.webpresence.com/sonicon/marcopolo
- ◆ pwWebSpeak, isSound – low vision browser. Specific features include; speech output, synchronised speech and screen magnification, simple keyboard interface. However, isSound has made the decision to discontinue selling, enhancing and supporting the pwWebSpeak non-visual browser effective, January 1, 2001 www.isound.com/pwWebspeak.htm
- ◆ Sensus Internet Browser, Denmark – low vision browser. Specific features include; speech output, Braille support, special screen fonts www.sensus.dk/sib10uk.htm
- ◆ Simply Web 2000, Talking interface using Internet Explorer engine. Specific features include; speech output, simple keyboard interface www.econointl.com/sw

Evidently, such systems do not support the need of people using graphic symbol based AAC who may also have multiple disabilities including physical and learning needs.

Alternative web browsing methods & authoring tools specifically designed for symbol users are rare. A significant exception is:

- ◆ ARNIT, (see figure 2) is a server based solution for web-browsing (and email). Symbol users' facilitators can access the user's site for personalisation of the user's interface (e.g. address book) from any computer that can contact the server over the Internet. www.netjob.dk/arnitsvenska

4.2 Filter and Transformation Tools

A number of tools for simplifying or transforming pages are available. Typically, filter and transformation software sit between the user and the server, transforming pages into more accessible format. Some tools used to improve the content of HTML pages are also hosted on the developers computer and used to transform local files. Examples of filtering and transformation tools include:

- ◆ A-Prompt (Accessibility Prompt) has been developed to assist Web authors in improving the accessibility and usability of HTML documents by checking Web pages for barriers to accessibility and making repairs to correct any problems. [\(http://aprompt.snow.utoronto.ca/\)](http://aprompt.snow.utoronto.ca/)
- ◆ Bettsie – a filter programme to create automatic text only versions. Web pages need to be configured for compatibility with the Bettsie programme www.bbc.co.uk/education/bettsie
- ◆ HTML Tidy (<http://www.w3.org/People/Raggett/tidy/>). Dave Raggett of the W3C has developed this utility for cleaning web pages by identifying and correcting HTML errors -- including accessibility problems. This runs on Windows 95/NT, MacOS, BeOS, OS/2, Amiga, and Linux and a variety of other Unix platforms.

- ◆ Inclusive writer and Writing with Symbols (Widgit Software Ltd.), these programmes will *automatically* transform text into symbols (with accompanying text), where text to symbol matches are found and where text is cut and pasted into the active programme.
- ◆ Link Grammar, a syntactic parser of English, <http://bobo.link.cs.cmu.edu>
- ◆ Tom is a web accessibility development tool, developed at the NCSA (National Center for Supercomputing Applications), together with the Trace Center. Tom is designed to convert graphical web pages to text-only pages, or hybrid text and graphics web pages. TOM is a web-based service that takes a URL and prompt you to add alternative text, then generate the new page for you or email it to you. (<http://lunch.ncsa.uiuc.edu/tom/tom.html>)
- ◆ The Opera browser includes features such as turning frames on / off, stylesheets, and images that can be useful when developing websites with an eye towards accessible design (<http://www.operasoftware.com/>).

4.3 Guidelines for Developing Accessible products

A number of resources are available to software developers keen to ensure accessibility for people with disabilities. Some of these resources provide more general advice and guidance on accessibility, whilst others are more focused on particular application areas. For the purposes of this review the following topics are of interest.

4.3.1 Guidelines for Accessibility

Principles of Universal Design – a trans-disciplinary collaboration from the Centre of Universal Design, NC State University, USA. Although not specifically targeted at Internet services or written for people with disabilities, these principles aim to guide product design in order to make it accessible and usable to all people without the need for adaptation or specialised design

The Trace Center - the Trace Center was established in 1971 to address the communication needs of people who are non-speaking and have severe disabilities. The Trace Center has subsequently expanded its scope to cover broader communication issues, and has been particularly active in the area of accessibility and universal design issues, and is also highly active in the specific area of WWW accessibility and a key player in the W3C initiative (<http://trace.wisc.edu>).

Include - This EU project was established as a support action to provide information concerning the *Design for All* of products and services for people with disabilities and the elderly. This includes providing advice on web accessibility, (further details are available at www.stakes.fi/include).

Major manufacturers have also developed guidelines for developing accessible applications. Apple, IBM and Microsoft have been particularly active in this area in recent years, for example:

- IBM Accessibility (Special Needs) (<http://www-3.ibm.com/able/guidelines.htm>)
- Microsoft Windows Guidelines for Accessible Software Design (<http://www.microsoft.com/enable/>)

4.3.2 Guidelines on Webpage Accessibility

The most significant initiative in this area is the work of the W3C. The World Wide Web Consortium was created to develop common protocols to promote the evolution and ensure interoperability. W3C has more than 500 members from around the world and has earned international recognition for its contributions to the growth of the Web. See <http://web4.w3.org/>. Through the W3C a number of publications have been developed. These include Guidelines for Web Content accessibility (<http://www.w3.org/TR/WAI-WEBCONTENT/>), as well as Guidelines for the development of WWW Authoring Tools (<http://www.w3.org/TR/ATAG10/>). A number of working groups are actively involved in developing guidelines in specialist areas, and it is possible that a proportion of this work will

be particularly relevant to WWAAC. For example, a draft specification for an XML markup language for speech synthesis has been developed (<http://www.w3.org/TR/speech-synthesis>). Closer investigation may also reveal other working groups of interest. Note- however that involvement in the W3C working groups is through membership only, the cost of which is prohibitive for smaller companies (full membership is \$50,000 pa).

AWARE (Accessible Web Authoring Resources and Education Center), established by the HTML Authors Guild, serves as a central resource for web authors learning about web accessibility. The AWARE Center was launched in April 1999 and has a special focus on the importance of designing for universal accessibility (<http://aware.hwg.org/>). As well as providing links to the W3C work, the site provides information and links to a wide range of practical tools that are useful for developers.

It appears then that detailed guidance is available for developing sites that facilitate access to. screen reader software, and to a lesser degree, for people with hearing difficulties and p people with physical disabilities. There are few guidelines given for improving access to the cognitive impaired or person with communication difficulties.

4.3.3 WWW evaluation tools

Evaluation tools perform analysis of pages concerning their accessibility and produce a report and a rating. Such tools can examine a web page and identify potential problems that may be corrected, including for example problems with HTML validation. It is noted however, that these tools are relatively crude, and are primarily concerned with ensuring that site components, such as tables, are optimised for use with screen reader software, and that ALT tags and other labels are included. Services provided include [W3C's HTML Validation Service](#) . The World Wide Web Consortium operates this service. The online validation tool can be downloaded and used to and evaluate pages for conformance with HTML 4.0 or other published standards. A recent development is the production of an accessibility-testing plug in for Dreamweaver web authoring software.

Founded in 1984 as the Center for Applied Special Technology (CAST), in Peabody MA, is an educational, not-for-profit organisation that uses technology to expand opportunities for all people, including those with disabilities. It is well known for producing the Bobby checking tool (<http://www.cast.org/bobby/>) which is useful for checking for accessibility, it will also provide information on browser incompatibilities, download time, and some HTML errors. Users can test page conformance by entering their sites URL on the Bobby site. A recent development has been to also provide a java application (downloaded) that allows the user to run the program locally. This is useful for testing pages (in bulk) before putting them on the web.

Examples of adapted Website / computer interface design include:

- ◆ [Meldrith Manor School](#), a website designed for switch access, using simplified symbol based interface (see figure 3).
- ◆ www.peepo.com, developed for people with learning difficulties, this site provides URL links using pages developed in simple graphic/picture based format (see figure 4).
- ◆ [Tascsupport.com](#), software designed to assist access to information and decision making for people with learning difficulties. Information may be represented in simplified form as text, symbols, pictures and sound. Facilitators create user interfaces (see figure 5).
- ◆ SymbolCity (Praatstad)

A project in progress for developing a virtual community for symbol-users, their peers and facilitators. Activities such as chat, education, leisure etc are under development. Dutch national telecom company designs web-pages without the need for symbol-images themselves.

From the (html-based) pages, a reference to symbols is made which are displayed by Symbol-for-Windows components installed on the user's computers within their web-browser.

Figure 2: example of ARNIT website

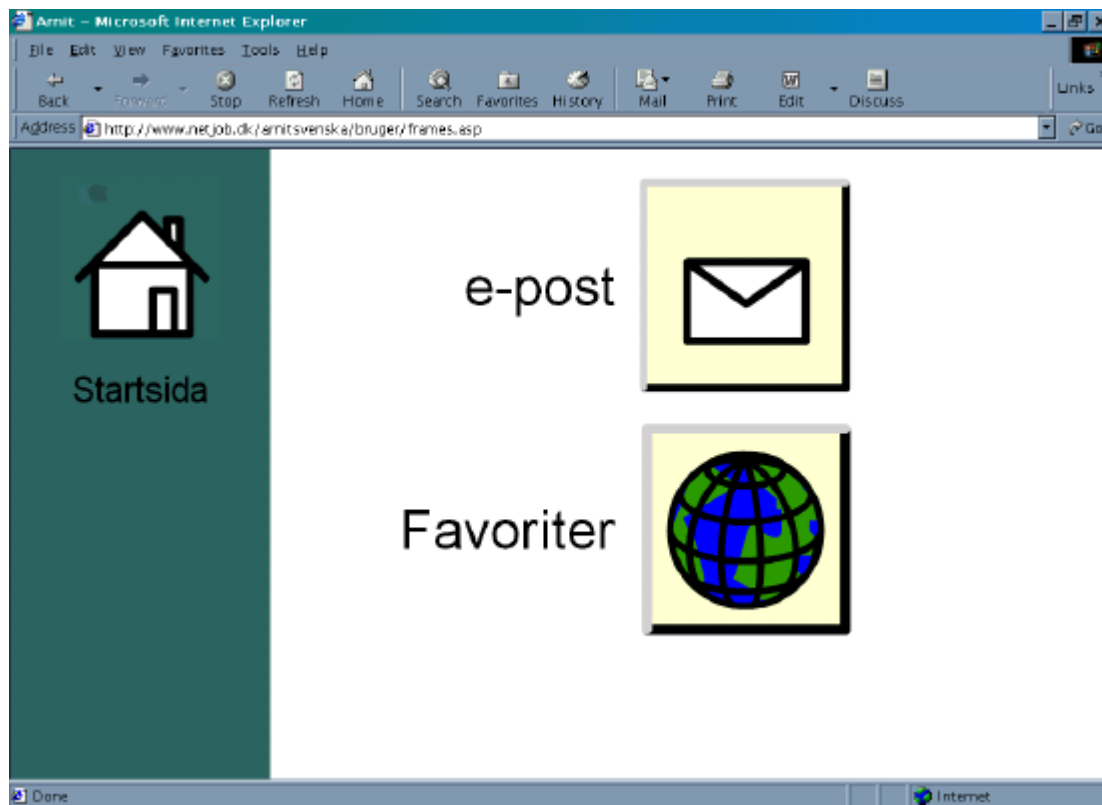


Figure 3: Meldreth Manor School Website



Figure 4: peepo.com

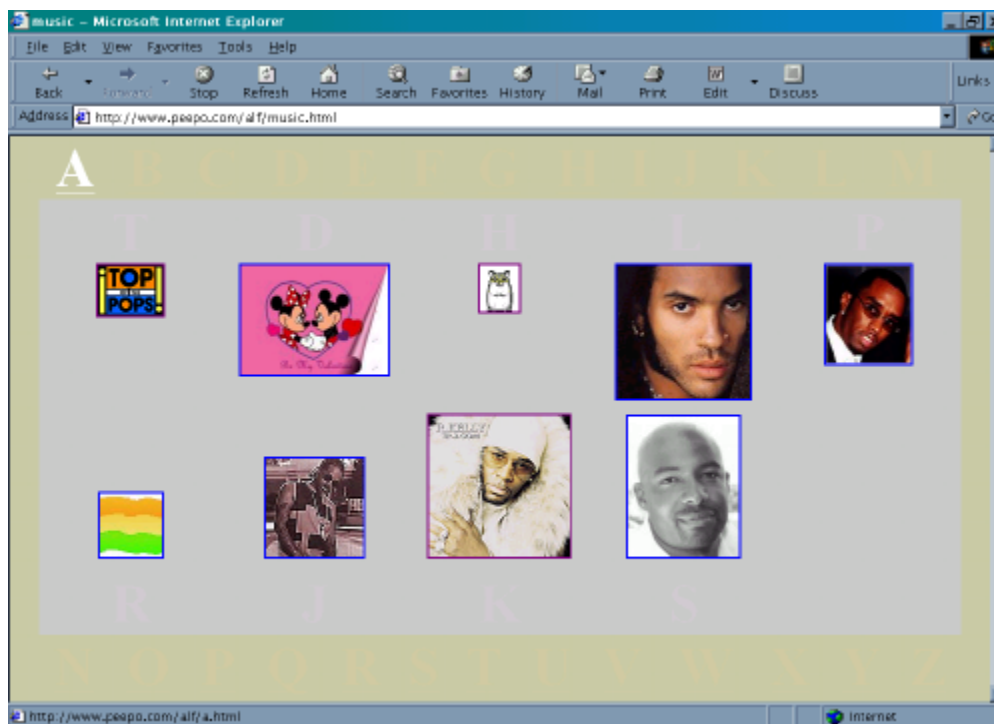
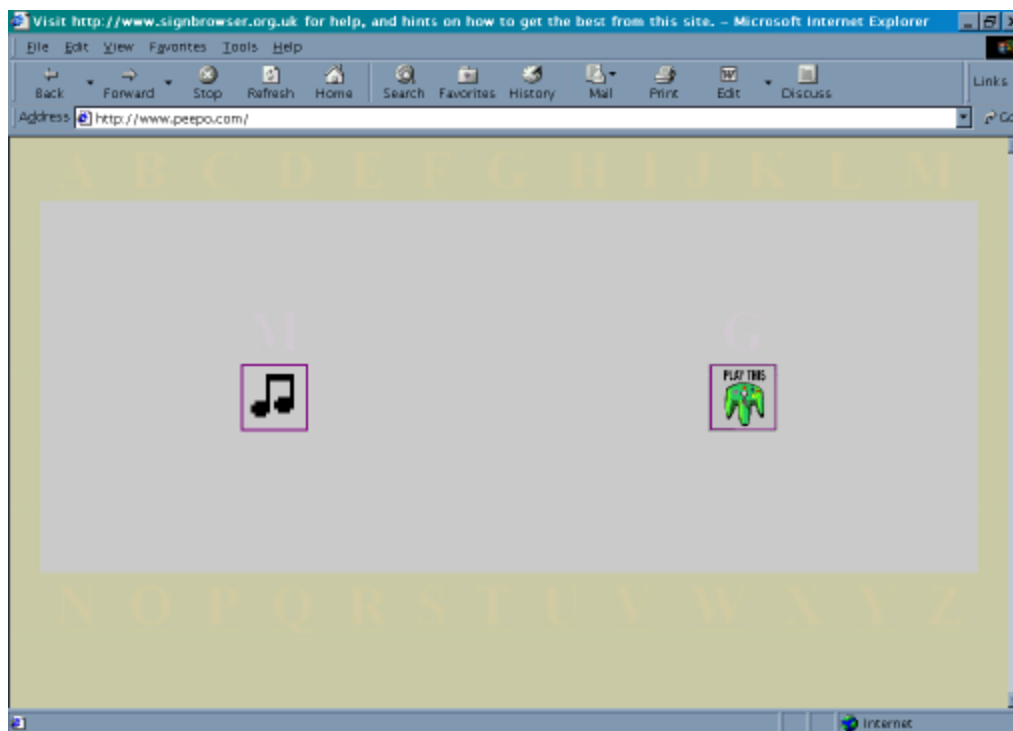
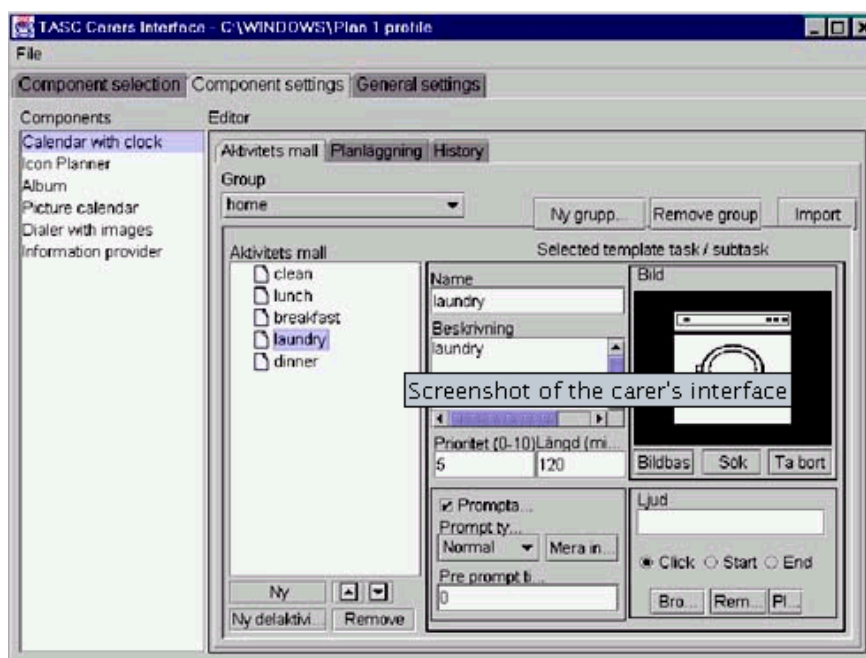


Figure 5: Tasksupport.com

Interface seen by user



Facilitators interface for creating the user interface



5.0 Developments In Email, Echat & Discussion Group Accessibility

5.1 Summary of Existing Email/Echat Software for Symbol Users

Apparently, no significant developments in email / echat / discussion fora for people with dysphasia have been identified). However, a number of developments concerned with supporting email / echat for people using symbol systems have taken place. The following then, is a summary of products/developments, described principally according to:

- (1) Basic strategy of adaptation (*standard* or *specialised software* employing *standard* or *specialised email/echat services*)³
- (2) Symbol systems, pictures and photos supported
- (3) Notable characteristics of User Interface
- (4) Support in syntax construction
- (5) Open or closed system – open systems integrate with other existing software, closed systems do not
- (6) Switch interface utility available (as part of closed system)
- (7) Presentation of message received by recipient

5.1.1 Inter_Comm - Commercially available Email package, Widgit Software Ltd. www.widgit.co.uk

- (1) Special software using standard server
- (2) Supports PCS & Rebus, pictures, and photos symbol sets
- (3) A number of simplified symbol based email functions are available (e.g. check inbox, address book, password) The number of email functions made available to users can be modified.
- (4) Set can be customised, system automatically includes the name of the addressee at the start of the message
- (5) Closed system – *Inter_Comm* works exclusively with WWS2000
- (6) Keyboard, mouse and switch accessibility is supported through WWS2000
- (7) Will convert incoming text based email into a PCS or Rebus symbol format. Recipients without *Inter_Comm/Writing with Symbols 2000* software receive text only.

5.1.2 Symbolmail – Email package, Anycom, www.anycom.se

- (1) Adapted interface employing standard services (MS Outlook 2000)
- (2) Supports PCS and Bliss – (via databases stored on the users computer)
- (3) No notable characteristics of User Interface
- (4) *Symbolmail* offers a forum for symbol based message composition/editing and email functionality, but *Symbolmail* does not directly support message construction
- (5) Open system, but relies on user having MS Outlook 2000
- (6) Default input modality is the keyboard. Symbol users employ their own preferred system/keyboard in accessing the *Symbolmail* adapted interface. That is, symbol-selection and switch input is not directly supported by *Symbolmail*
- (7) Messages may be sent as HTML or as plain text. *Symbolmail* will convert incoming text based email into a symbol format where corresponding text-symbol concepts can be identified within the PCS and Bliss databases

5.1.3 Mind Express – Internet Relay Chat facility – Technologie & Integratie

- (1) Special software using specialist host, (Technologie & Integratie maintain the server).
- (2) Supports Bliss, PCS, BECTA, Pictograms and pictures and photos

³ another way of thinking about this, is to classify products as; server based adaptations or user based adaptations

- (3) Users represent themselves in the chat environment by creating a face (tool for creating different faces is provided), or photo. Faces can be modified to express the mood of the message (happy, sad, angry)
- (4) Grammar module within Mind Express will automatically conjugate verbs in symbol to speech. Does not translate between different languages or symbol sets
- (5) Closed system – the Internet Relay Chat facility works exclusively with Mind Express
- (6) Keyboard, mouse and switch accessibility is supported (through Tellus application?)
- (7) Uses text and text to speech output

5.1.4 BlissInternet – <http://home.istar.ca/~bci/blin2.htm>

- (1) Special software using specialist server
- (2) Supports Bliss
- (3) No notable characteristics of User Interface
- (4) No support in syntax construction
- (5) Closed system (uses components Blisswrite and BlissInternet)
- (6) Keyboard, mouse and switch accessibility is supported
- (7) Bliss

5.1.5 Clicker 4.0 - Crick Software Ltd. www.cricksoft.com

- (1) Special software using standard services
- (2) Supports PCS, Rebus, pictures and photos
- (3) No notable characteristics of User Interface
- (4) No support in syntax construction
- (5) Closed system
- (6) Symbol-selection and switch input is supported
- (7) Email sent as HTML file

5.1.6. Bliss for windows – Handicom www.handicom.nl

- (1) Special software using standard services (Email facility within document maker facility (a programme for creating and editing documents in Bliss
- (2) Supports Bliss
- (3) No notable characteristics of User Interface
- (4) No support in syntax construction
- (5) Closed system
- (6) Keyboard, mouse and switch accessibility is supported
- (7) Email sent as HTML file

5.1.7 Symbols for windows - Handicom www.handicom.nl

- (1) Special software using standard services
- (2) Supports PCS, Rebus, Bliss, Pictograms, Beeldlezen, Weerklank Foto's, Multiple Choice Foto's
- (3) No notable characteristics of User Interface
- (4) No support in syntax construction
- (5) Closed system
- (6) Keyboard, mouse and switch accessibility is supported
- (7) Email sent as HTML file

5.1.8 ARNIT www.netjob.dk/arnitsvenska

- (1) Server based solution for email (and web browsing). No special program on the user's computer is needed, it goes through the Arnit service provider and displayed by a standard web-browser
- (2) N/a
- (3) The facilitator can access the user's site for personalisation of the user's interface (e.g. address book) from any computer that can contact the server over the Internet. Simple use of animation

- (4) No support in syntax construction
- (5) Modular system
- (6) No switch interface utility available (as part of closed system)
- (7) No symbol translation

5.1.9 dARNIT – Darts ARNIT

- ◆ A specially developed program on the user's computer offers more support than Arnit.
- ◆ Being developed in Java, it could be used as basis for prototyping
- ◆ Both message and input is character-based
- ◆ program will be supplied to all consortium partners

5.2 Other developments include

- ◆ SymbolCity (Praatstad) A project in progress for developing a virtual community for symbol-users, their peers and facilitators. Activities as chat, education, leisure etc are under development.
- ◆ www.rcl.it/bliss www.rcl.it/rcl_forum/totem/bliss/html (Bliss chat /discussion forum program), not very active
- ◆ www.kuulalaakeri.fi/eng/ (Mobile icon-based messaging for those with speech or language disorders) www.imagetalk.fi
- ◆ IPA, Intelligent Personal Assistant (for Elderly) – prototype developed by KTH

The products described here illustrate a range of responses to the challenges of supporting symbol users in accessing and using Internet services.

6.0 Linguistic Support For Senders And Recipients Of Email

6.1 Face-to-face interaction

A proportion of research in the field of AAC and communication disability has been concerned with exploring the nature of interaction between symbol users (both adults and children), and their communication partners. The heterogeneity of populations sampled, variations in procedures adopted in studies, the use of different models of interaction informing analysis and variation in communication partner, does mean that comparisons between studies are difficult⁴. Nevertheless, common themes and patterns in the findings emerge. Essentially, it seems that verbal partners (parents, teachers, careworkers, friends etc.) produce mainly initiating moves in interaction with children using AAC, (Harris 1982, Udwin and Yule 1991, Basil 1992, Jolleff et.al 1992, McConachie et.al. 1999, Pennington and McConachie 1999). They may take more turns in the conversation, and produce more complex utterances in terms of the number of communicative functions within each turn (Harris 1982, Light et.al 1985). People using symbol systems, on the other hand, are reported to demonstrate minimal conversational 'control'. They may appear to adopt passive roles in such interaction; acting as the respondent to adults' questions, often with single word responses and employing a limited range in variety of speech acts. Similarly, studies of interaction involving people with dysphasia and communication partners has identified a reliance on non-verbal communicative strategies.

Beyond descriptions of the characteristics of interaction, inductive methodology have been concerned with demonstrating *how* conversation is managed between symbol users and their verbal partners⁵. For instance; (1) how adults using AAC systems and speaking partners collaborate in dealing with misunderstandings in the co-construction of referents, (Collins, 1996), (2) how the design of AAC users' turns and their interpretation by 'natural' speakers present specific difficulties for ending conversations and how these difficulties are dealt with (Collins, Markova and Murphy 1997), and (3) how in telling news it appears that news tellings develop in the most part through the actions of 'natural' speakers employing question-answer sequences (Collins and Murphy 1994).

In summary, conversation between people with communication disabilities and non-disabled partners involves the non-disabled partner in considerable work as both participants employ interactive strategies to negotiate meaning and steer the conversation together. As such, people with communication disabilities may choose, or be required, to use grammatically simplified or incomplete sentences or phrases. However, within computer mediated communication (CMC) an environment where co-construction, repair and clarification is limited, environment limited or telegramatic messages may lead to misunderstanding and confusion for the recipient.

6.2 Computer Mediated Communication

Email appears to occupy a unique position in linguistic culture. That is, language use in email does not appear to match the expectations of narrative design typical of traditional orthography (letter writing, for example), nor does it mirror the richness and subtlety of face-to-face interaction. In traditional writing environments authors typically work to produce unambiguous writing, not least because the intended audience may have little or no opportunity to clarify vagaries. Conversely, in an email environment the recipient may respond quickly to clarify any potential misunderstanding. Arguably then, email can accommodate use of more ambiguous or less formal writing style (Sherwood 1994). This is exemplified in the proliferation of jargon / acronym use in email (for example, ROTFL - [I am] Rolling On The Floor Laughing [at what you wrote]).

⁴ For example, parents and teachers are likely to have different levels of experience in communicating with children with physical disabilities using communication equipment as well as different expectations for interaction (Pennington 1996).

Face to face interaction involving people with communication disabilities is often negotiated/jointly constructed between both communication partners, and communication partners may employ a variety of strategies to identify ambiguous messages. This may involve the verbal partner in working to clarify the mood of the statement, the temporal context, whether it is about the user or someone else, the function of the message (asking a question, providing information etc), and so on, and the person with a communication disability may employ a range of non-verbal strategies (gesture and facial expression, for example) in message construction. Interestingly, similar supportive strategies in message construction have emerged in use of computer mediated communication. For example, emergence of the use of *emoticons*; graphic icons, used to augment message content such as :-(- indicating sad, and :-) indicating happy. Similarly, pause equivalents (Weeeeee.....errrr, for example), and creative punctuation (!!??) appear increasingly commonplace (Sherwood 1994). Indeed a shift from formal styles of written communication to less formal expressions similar to those described above have been documented in contributions to an academic discussion forum (Veselinova & Dry 1995).

In addition to the development of unique forms of message construction, new accepted structures of communicative interaction have surfaced. Analysis of structural aspects of computer mediated conversation in echat has reported distinctive *ground rules* for participation. It appears that accepted rules of interaction include instances where several conversations can occur simultaneously, conversational topic may diverge frequently (perhaps more so than in face to face conversation), participants can converse in more than one conversation at a time and the rules of turn taking do not reflect spoken conversation (<http://www.polisci.wisc.edu/~rdparrish/Chat%20Rooms%20for%20Web%20Site.htm>).

6.3 Electronic selves

Computer mediated communication may be conducted anonymously. Consequently, the electronic self presented in CMC may not reflect the embodied self (either intentionally or unintentionally), and aspects of the embodied self will only be revealed if the end user chooses to reveal them. This can present problems and opportunities for end users in the presentation of self to others, (Miller 1995). It is possible that people with disabilities may not wish to include characteristics of their disability in their electronic self. However, it is possible that end users may converse with those adopting fraudulent and exploitative identities (Miller 1995).

7.0 Support For Linguistic Structures

Symbol systems (high tech) offering rule based linguistic support to users are limited. The following is a summary of such systems:

Compansion – University of Delaware, A.I. du Pont Institute. In this system, one or more words are given, and it is attempted to insert words that are not given to make a complete sentence, giving an interpretation which may or may not be what the symbol user intended. However, it is possible that incorrect interpretations are given because of undesired words being inserted.

Blisstalk –here rules work to "put the right endings" on words, ie appropriate grammatical markers, and to supply the correct forms of pronouns depending on their grammatical function/placement in the sentence. This means that the symbol user does not have to choose the correct inflectional forms of a word as in most other symbol system applications. The symbol user does have to indicate (by means of a symbol) if the past or future tense of a verb is desired, or if the plural form of a noun is desired. Extra words are not filled in as with Compansion. This means that the user has to supply a symbol for each word. But, on the other hand, incorrect interpretations are not given because of undesired words being inserted.

Hyperbliss - late 80s early 90s south African Bliss prediction offering word pairs. For example, in response to in insertion of determiner a range of possible noun option are offered.

8.0 WWAAC project

The ultimate goal of the WWAAC project is to make the electronic highway more accessible for a wide range of persons with language and/or learning difficulties. This will be accomplished by developing software which can translate symbols into either text or other symbol sets to enable a person with communication disabilities to use the world wide web, email and echat or discussion group facilities. The 'design for all' principles supported by WWAAC are underpinned by the role of the 'user' both within the initial design and subsequent evaluation phases of the project. The methodology used to identify and clarify the users' needs for the software developed in WWAAC is outlined below.

9.0 Methodology

9.1 User Identification

From a functional point of view, the project defined the primary end users of WWAAC to be:

People who use graphic symbol-based augmentative and alternative communication (AAC) systems to support/replace speech and/or reading and/or writing, and older people with communication disabilities who may, or may not, be relying on symbol based communication aids, but who would benefit from adapted computer software, to help them access Internet services

These end users will include people with a range of disabilities:

- People with physical disabilities such as cerebral palsy (C.P.) with severe dysarthria
- Elderly people with dysphasia
- People with learning difficulties

Subsequently the target population also includes

- People who access their communication equipment directly, e.g. through a keyboard or mouse (with or without adaptations) or can point at paper-based communication charts/books

and

- People who access communication equipment indirectly, through alternative access methods, e.g. scanning via one or more switches

The project consortium agreed that end users' receptive language and cognitive abilities would largely determine the potential benefits received through WWAAC. In adopting a social model perspective of disability inclusion criteria were described according to the demands of the tasks involved rather than measures of impairment. WP1 therefore aimed to identify people who have:

- *receptive* language abilities sufficient to understand discussion concerning strengths and weaknesses of technology
- *Cognitive* abilities such that they are able to think about, and understand, abstract concepts such as *email*, and *discussion fora*
- Adequate *visual* acuity and visual processing abilities to work with pictures, symbols and/or simple text on a computer screen
- An interest in the internet and *motivation* to explore ways of using Internet Services

There were no criteria specified for expressive communication skills although preference was given to people who typically employ AAC as their primary channel of communication in face-to-face conversation (as judged by professional service providers) rather than speech. By targeting existing users of AAC technology, the project would be able to identify future needs more easily, ensuring progress towards defining the user requirements with some degree of accuracy and confidence. However, other potential users may ultimately benefit from aspects of WWAAC, and these could include users inexperienced with AAC (e.g., primary aged children), those with learning difficulties in the absence of severe speech impairments, those requiring manual sign-supported communication but are not hearing-impaired, as well as for people with specific learning difficulties (dyslexia). These groups may be more actively included later during the evaluation phase of the project.

Categories of users to be involved in the project were specified by identifying various usage scenarios for Internet access.

9.1.1 Primary school aged children

Very young children are unlikely to meet the inclusion criteria for receptive language and cognitive abilities and are subsequently less likely to benefit from the project developments. Technology is important to consider for these groups, but stand-alone communication devices and educational software is a much more likely scenario for usage. For this reason they were excluded as a primary user group for the project.

9.1.2 School aged children (10-18yrs)

The professional experience of the WWAAC consortium partners suggests that the majority of Internet users are likely to be young, school-aged children who are professionally supported in their use of AAC and the Internet within schools and colleges. There will also be a smaller proportion of young users receiving non-professional support at home. This age group was considered highly likely to be motivated in the use of Internet technology, in line with their non-disabled peers. (In addition by age 10-11 yrs Internet use is introduced to the National Curriculum in UK). It is possible end users of school age are also more likely to benefit from language support in their use of the Internet, and so will particularly benefit from the language support applications developed within WWAAC. For the purpose of this project, children using AAC aged between 10 and 18years were identified as the primary participants in WWAAC project activities.

9.1.3 Adults with congenital communication disabilities

This population is also likely to demonstrate motivation in the use of Internet technologies, and many will meet inclusion criteria. However, the question of motivation was considered less predictable than for younger populations in school. Typically also, state funding of education also provides more initiatives and resources for ensuring young adults have access to the resources they need in this area. It was agreed that this group were a target population for WWAAC but perhaps less so than the school aged population.

9.1.4 Elderly people with acquired communication disabilities

There will be a much smaller number of elderly Internet users who receive professional support in an institution or non-professional support at home. More elderly users can also be expected to show some resistance to using technology if they have little prior experience, and may also suffer from receiving less support from care professionals and family members in using new technologies. However, given the relatively high incidence of strokes in the elderly population (Stroke is the largest single cause of severe disability in England and Wales, with over 300,000 people being affected at any one time – see for example <http://www.stroke.org.uk/facts.htm>), and the potential benefits for this population in the WWAAC project task support research and development, it was considered important to consider the needs of those with an acquired communication disability.

The requirements capture therefore aimed to sample from school aged children and adults, and reflect supported use of AAC in a school or college, and non-professional support at home. The sampling distribution to be adopted in the data capture activities was agreed by consensus within the consortium . This is represented by the following table:

Table 1: Estimated proportions of User Categories

		Adult	
<i>Use of Internet</i>	School Age (10-18)	Adult (congenital)	Adult (acquired)
Home Use	20%	10%	15%
Institutional	30%	10%	15%
Totals	50%	20%	30%

9.2 Additional Stakeholders

In addition to the user groups discussed above, there are additional groups of stakeholders who will benefit from the symbol translation facilities and/or from the web authoring tools developed in the WWAAC project, and their views can inform user requirement. As part of the user requirements elicitation, the following users were also identified for inclusion in the user requirements capture:

- Software and Hardware developers and distributors of high tech AAC
- Professional facilitators, including service providers, therapists, teachers, information providers, curriculum developers, etc.
- Family, informal carers, young (non-disabled) friends, schoolmates or colleagues in supported work environments.

The latter two categories were considered particularly important to include, as it is understood that these groups would be critical in the take-up and ongoing use of technology for many users. However, in the early stages of the recruitment procedure, it became apparent that use of computer technology and Internet services was taking place predominantly in institutional settings (schools, colleges, residential homes). Subsequently, the user requirements capture from non-disabled stakeholders focussed on the opinions and views of professional facilitators and service providers rather than informal carers and family members. Additionally, it is likely that service providers will have a broader experience of the barriers to assistive technology use with a greater variety of end users.

In many instances, people using AAC equipment require assistance from non-disabled people in the use of technology, both in the setting up and operating of equipment. For this reason, these groups of stakeholders will also be invited to take part in the evaluation of the project software. This will include not only the evaluation of Internet access applications developed in the project (Workpackage 6), but also the web authoring tool for webmasters (Workpackage 7) to ensure accessible websites for non-readers and persons with learning difficulties.

9.3 Final recruitment

9.3.1 End User (see summary table 1 below)

The user requirements capture recruited 28 individuals, 14 of school aged (age range 12 – 18yrs, median 17yrs), 8 within the adult congenital category (age range 21 – 42yrs median 27yrs), and 6 older people with dysphasia (age range 40 – 75 years, median age 58 ½ years). The following table summarises the distribution of subjects. The recruitment mirrored expectations identified by usage scenario.

Table 1: Summary End User Characteristics

ID	Country	Location*	Age	Diagnosis	Aetiology	Mobility	Symbol / icon	Primary AAC/software
1	Sweden	College	17	4 limb CP	con	w/chair	Bliss	chart
2	Sweden	College	17	4 limb CP	con	w/chair	Bliss	Deltatalker
3	Sweden	School	13	4 limb CP	con	ambulant	Bliss	chart
4	Finland	College	17	4 limb CP	con	w/chair	Bliss	Assistant software
5	Finland	College	15	4 limb CP	con	w/chair	Bliss	Assistant software
6	UK	School	15	4 limb CP	con	w/chair	PCS	book
7	UK	School	16	4 limb CP	con	w/chair	PCS	book
8	UK	School	14	degenerative	con	w/chair	PCS	book
9	UK	School	12	4 limb CP	con	w/chair	PCS	book
10	UK	College	17	4 limb CP	con	w/chair	Bliss	Deltatalker
11	UK	College	18	4 limb CP	con	w/chair	LLL	Liberator
12	UK	College	18	4 limb CP	con	w/chair	LLL	Liberator
13	UK	College	18	4 limb CP	con	w/chair	LLL	Liberator
14	UK	College	18	4 limb CP	con	w/chair	LLL	Liberator
15	Sweden	Home	36	4 limb CP	con	w/chair	Bliss	chart
16	UK	res home	29	4 limb CP	con	w/chair	wordboard	Pathfinder
17	UK	res home	33	4 limb CP	con	w/chair	word & letter board	ORAC
18	UK	res	42	4 limb CP	con	w/chair	Bliss	Dynavox
19	UK	Home	24	4 limb CP	con	w/chair	LLL	Deltatalker
20	UK	res home	24	2 linmb CP	con	w/chair	none	Deltatalker
21	UK	res home	25	4 limb CP	con	w/chair	none	Lightwriter
22	UK	College	21	4 limb CP	con	w/chair	dynasym	Dynamyte
23	Sweden	Day Care	58	Dysphasia	CVA	ambulant	none	none
24	Sweden	Day Care	40	Dysphasia	Head injury	ambulant	none	none
25	UK	Home	50	High level dysphasia	Brain tumour	ambulant	none	none
26	UK	Home	69	Dysphasia	CVA	ambulant	none	none
27	UK	Home	75	Dysphasia	CVA	ambulant	none	none
28	UK	home	59	High level dysphasia	CVA	ambulant	none	none

Location = Primary location of computer use

res home = Residential home

CP = Cerebral Palsy

Con = Congenital

CVA = Cerebral Vascular Accident (Stroke)

LLL = Language, Learning and Living (Minspeak Application Programme)

9.3.2 Service Providers

In total 51 service providers, including mainly professional facilitators, were interviewed. Their job titles included speech and language therapists (at various levels of seniority), speech and language pathologist, occupational therapists, teachers, clinical coordinator, clinical manager, director of centre, AAC specialist, ICT coordinator/consultant/engineer, educational workers, and representatives from a stroke and dysphasia federation.

Country	No. of Service Providers
Spain	1
Denmark	3
Finland	3

Netherlands	7
Sweden	14
United Kingdom	24
Total	51

9.3.3 Manufacturers

A total of 10 manufacturers, including software and hardware developers and distributors, were interviewed, half of whom were based in Sweden. Half the sample described themselves as product developers, and all were involved in distribution activities. 70 % of the sample were involved in hardware development or distribution, and 70% were involved in the distribution or development of software products. Only 40% of the sample were involved with hardware and software products. The majority of respondents (70%) were at a managerial level within their company.

10.0 Measures

10.1 User Centred Methods and Tools

In order to identify the need for a new technology it was important to understand the limitations and capabilities of the user group along with their needs and objectives. Tools were developed emphasising the influence of operating context in determining requirements, and the importance of understanding where and how a product is likely to be used (Cook & Hussey 1995). In order to capture these diverse requirements, different tools were developed to include end users and experts (service providers, professional facilitators and software/hardware developers).

10.2 Questionnaire measure (Description of the User Platform)

In order to understand the context in which AAC devices were used, and how best to include the different stakeholders likely to be involved, (end users, facilitators, for example) across the User Platform, the ACE Centre administered a questionnaire to members of the User Platform prior to the commencement of the project. This task identified:

- strengths of the user organisation
- specific user groups within each organisation
- the organisation's experience and level of expertise with AAC and the Internet
- users' experience and level of expertise with AAC and the Internet

This enabled a more focussed involvement of users from the start and prepared the way for capturing the diverse requirements identified in the functional model used.

10.3 Interview measures

10.3.1 User Interviews

A specific procedure was required rather than verbal /written presentation of open questions because;

- ◆ For children using AAC, it is possible that their communication systems may not contain appropriate symbol vocabulary to express ideas, opinions, and feelings.
- ◆ Discussion with professionals in the field of AAC suggested that children may not have been asked to express views of this nature before and might require support in their analysis of issues
- ◆ People with learning difficulties experience difficulty in a meta-analysis of this sort. That is, they may struggle to consider and express opinions on relatively abstract issues
- ◆ People using AAC may have little experience discussing complex issues, thinking through ideas of this type and assessing the current situation regarding AAC
- ◆ No suitable published materials were available

Subsequently, the methodology for interviewing AAC users was drawn from two techniques: Rich Pictures (Checkland, 1981) and Talking Mats (Murphy, 1998). These are described in more detail below, followed by the specific way in which these ideas were developed for use in the WWAAC project.

Rich Pictures Model

A wide variety of systems analysis tools have been developed in order to assist in the process of understanding complex systems, and some of these concepts are also of relevance for use in more general interviewing activities. Some of these techniques are also primarily non-verbal, and lend themselves for use with people who do not use written language as a communication medium. Simple graphical representation techniques may be of particular value, and in particular some of the soft systems analysis ideas developed by Checkland and others may also be of use (e.g. Checkland 1981). This approach takes a systems oriented approach to analysis, and in addition to this structured

framework, also provides tools that can assist in representing complex problem spaces. The best known of these are Rich Pictures, which as the name suggests are simple diagrammatic representations of how all of the elements, e.g. people and processes, fit together in a given situation. What makes Rich Pictures particularly powerful is that subjective as well as factual information can be combined into one diagram, to provide a composite view of a problem space that would be difficult to represent in words.

Using these concepts as a basis for development, a simplified representation technique was developed for use in the WWAAC project, involving elements from soft systems analysis as well as other techniques specifically developed in the AAC sector. This involved symbolically representing the individual as the element of a much wider system that includes objects and people within the person's world of discourse. In addition to being able to represent the relationships between these different objects, subjective feelings regarding these objects can also be represented on the same diagram. Representation of the individual within a wider system provides important contextual cues that assist the individual with poor verbal communication skills in articulating their feelings towards the different elements making up this environment.

Talking Mats

This framework for data collection was developed by the AAC Research Unit at University of Stirling to address the problem of discussing abstract concepts or issues when the users AAC system does not contain the required range of vocabulary. Sets of pictures are produced to illustrate issues which researchers wish to include in the interview. Different emotions can then be depicted to allow AAC users to indicate their feelings towards each of these issues (e.g., whether he or she feels happy, content, bored, confused, worried or angry). Each picture chosen by the user can be arranged on a textured mat and attached by Velcro™ so that a visual representation can be built up about the user's feelings on a particular topic.

Feedback following the use of Talking Mats at University of Stirling indicated that this interview tool could significantly enhance the ability of AAC users to express their opinions about abstract concepts or issues that they do not often address in their everyday conversations. The WWAAC project drew from this technique as well as the soft systems approach described above, in developing its interview strategy to understand better AAC users feelings about using computers, the Internet, email, discussion groups and echat. This would, for example, elicit whether a particular user finds an activity like using the Internet fun or boring, useful or useless, and what their aspirations are for future use of these facilities. An interview procedure adapted from Talking Mats has been used to elicit the views of school aged children using AAC systems concerning Speech and Language Therapy services and their opinions concerning AAC systems and communication aid use (Clarke et.al 2001).

Subsequently, the user interview developed a two stage interview measure, the first building on the principles of the Rich Pictures Model and the second stage adapted from the principles of Talking Mats.

Stage 1:

Participants were asked to identify issues, interests or activities pertinent to their life experience. In initiating this task the interviewee was directly asked about the relevance an activity, for example listening to music, watching sport. The validity of decision-making was probed by asking whether an unlikely activity, one that was not age appropriate for example, was part of that individual's experience. As items were identified they were drawn within a circle presented on a large piece of paper. In this way a composite visual representation of four or five significant issues in the individual's life was constructed. If use of computers had not been spontaneously included in the picture, the interviewee was asked whether computer use might be included in the circle as part of that person's range of experience. As participants were known users of computers this question again probed the validity of decision-making. The interviewee was then asked to identify which elements of the

composite picture they engaged in independently. Assisted and independent activities were marked as appropriate. Where the need for support was indicated the interview probed the types of support required. The possibility that elements within the picture were conducted with or through the use of a computer or assistive technology was then explored. For example, if music had been indicated as an important interest in the individual's life, this interest was explored further to see if it was currently supported using computer technology. If so, then that particular interest and the computer were visually linked with an arrow.

Next, the interview explored issues, interests or activities that the interviewee would like to engage in but could not currently do so. As items were identified, they were drawn outside the circle (see Figure 1). At this point, the interviewees were asked to comment directly on their experience of Internet services (if these had not already been raised), and a visual representation was drawn outside or within the circle accordingly. Throughout the interview participants were encouraged to elaborate on their decisions through open discussion. In seeking to represent computer and Internet use visually, in an agreed composite picture, it was intended to support people using AAC in thinking about and reporting their views with some authenticity. The reliability of responses concerning the central themes explored in stage 1 (use of computers/Internet, like or dislike of computers/Internet and help required in computer/Internet use) was checked in stage 2. and further barriers were explained

Stage 2

Interviewees were asked to locate a symbol representing computer use on fourteen dimensions, and a symbol representing the WWW and email on three dimensions each⁶. Each construct dimension was presented on a laptop computer using Microsoft PowerPoint software (see appendix 2 for examples). Each dimension, concerned with a particular aspect of computer use, presented opposing poles of opinion, and a half way point, (for example easy to fix errors - half and half - difficult to fix errors). The issues raised for discussion were identified through a review of the literature and a focus group discussion conducted with eight specialist staff in the field of AAC at the ACE Centre Advisory Trust, Oxford UK. Interviewees then, were asked to consider whether they recognised a range of possibilities presented as relevant to their own experience. As a decision was made, the interviewer moved the symbol to a position on the dimension as indicated by the interviewee. In this way the procedure made few demands on the expressive abilities of the interviewee a potential springboard for further discussion.

This form of symbol-based procedure was preferred over a more traditional Likert scale (Likert and Katz 1948, Likert 1956). The symbol-based procedure generates a semi-permanent representation of the issues under discussion in the symbol system of the user. This is likely to have the affect reducing memory load involved in the task. The use of symbols also recognised users symbols as a valid method of expression. Furthermore, the arrangement of the positive and negative poles of the dimension was kept constant throughout the interview. It is possible that the findings were, consequently, influenced by a primacy effect. However, it is possible that, for participants who are unfamiliar with exploring their own views in this way, varying the organisation of the scale may impact on the validity of the procedure by increasing the probability of errors in symbol placement. This is particularly relevant in light of the limited opportunities to check the reliability of responses. That is, accurate decision making, for this population, may be hindered by the additional demands of close inspection of the construct dimension in addition to understanding and thinking about the question (Plumb and Spyridakis 1992).

Following the completion of Stage 2, the interview returned to the Rich Picture developed in Stage 1. The interviewer then attempted to draw links between computer use and elements

⁶ The dimensions concerned with the www and email were fun/boring, useful/useless and cool/uncool. The cool/uncool dimension was only presented to younger users in educational settings

placed outside the circle (see Figure 3). In this way it was intended to illustrate that desired activities and interests currently outside the life experience of the individual might be achieved through use of Internet services, bringing items *outside* the circle *into* the circle. It is possible that, in drawing these links, the interviewer may be viewed as an advocate for technology consequently influencing interviewees' responses. However this element of the procedure was conducted at the end of the interview, avoiding this potential bias. Indeed, during the consent process the interviewees were made fully aware of the work of the project, and the possibility that the study might impact directly on the lives of the participants. The potential bias introduced through such discussion was considered outweighed by the ethical demands of fully describing the subjects' participation in the study and hence the likely improvement in the credibility of findings documented through this procedure.

10.3.2 Additional Stakeholder Interviews

Specifically these tools included:

- Expert questionnaire for interviewing service providers (including professional facilitators, speech and language therapists, teachers, curriculum developers, information providers, etc., and also non-professional facilitators, including personal assistants and family members, see appendix 3)
- Expert questionnaire for interviewing designers and developers (including software and hardware developers and distributors of high tech AAC, see appendix 4)

10.4 Observation measures

Where possible, observation was also used to better understand the particular problems and requirements of AAC users using computers and the Internet. However, since most end users experienced limited access to computer technology, and were able to operate Internet technologies only with the assistance of a non-disabled assistant, observation had limited use during this phase of the project. In addition, it was found that a proportion of those interviewed were experiencing significant difficulties in accessing computer technology at the time of interview, again reducing opportunities to directly observe computer use. Where observation was not possible, informal observation of the use of AAC equipment gave insights into issues of accessibility and usability of advanced technologies.

When working with this particular type of client, it is important to have tangible products, and these user requirements have to be seen as only a starting point for the project. Once a prototype of the WWAAC software is available for evaluation with users, direct observation will become a primary method of data collection.

10.5 Subject measures

End user characteristics documented included:

- Age
- Location
- Diagnosis & Aetiology
- Visual abilities – acuity & oculo-motor abilities
- Hearing status
- Mobility – wheelchair user, ambulant
- Symbol/icon system used
- Primary communication aid (as judged by local service provider)
- Method of AAC access
- Keyboard and pointer adaptation
- Expressive use of symbol combinations
- Expressive use of grammar
- Literacy skills
- Internet services used
- Primary location of Internet service use

11.0 Procedures

11.1 End User Recruitment

End users were identified through their involvement or association with organisations of the User Platform. In the UK additional recruitment was conducted through the user forum of the Foundation for Assistive Technology. In the first instance, end users were approached by a local service provider (speech & language therapist, IT manager, for example). This was followed up by a visit from a member(s) of the WWAAC consortium. A screening checklist was provided to members of the User Platform to aid identification of suitable candidates (see appendix 5).

11.2 User interviews in WWAAC

One-to-one interviews were based on the following principles:

- ◆ Establish confidentiality between the interviewer and the end user
- ◆ Inform the end user that the interviewer will keep some notes
- ◆ Establish that there are no right or wrong answers
- ◆ Establish to the end user that they can stop the interview at any time (Beresford 1997).

The use of interview tools varied between individual end users. It is possible that the interview procedure employs strategies that are fairly typical of activities carried out by end users in institutional settings, (students in school and young people at college). As such, these procedures may appear more familiar in their design and presentation. This may not be the case for older end users, particularly those living independently and for some more mature and communicatively competent end users, the use interview tools developed was considered less fitting to their abilities and maturity. Therefore, a decision to use interview tools over verbal presentation of information was taken at the time of interview itself.

Typically, the interview procedure was completed within 45 minutes to 1 hour. However, time constraints within educational day care settings where a ongoing programme of events is in place have meant that the interview procedure has, on occasions, been limited to 30 minutes

The detailed User Profile Tool was administered following the user interview.

11.3 Interviews with Manufacturers & Service Providers

Experts (service providers and software/hardware developers) were contacted, informed of the aims and objectives of the project, and invited to take part in an interview over the telephone at a pre-arranged time. A questionnaire was then posted so that they could review the types of questions beforehand. In some cases, another person was subsequently suggested who might be more suitable to answer the questions. For example, one speech and language therapist working solely with infant children felt that someone working with older children would be more appropriate, and hence another interview time was scheduled. A limited number of interviews with non-professional facilitators were also conducted when interviews with their AAC users took place.

12.0 Analysis

Key themes and concepts were confirmed through shared discussion between researchers, and frequency counts of the number of issues by type.

13.0 Findings

13.1 Interviews With End Users

13.1.1 Attitudes, aspirations and expectations towards computer technology

All end users interviewed, with the exception of 1 person, said that they use computers, and 27 of the 28 users interviewed said that they liked computers. 1 person reported that although he used computers he did not like them because he experienced significant difficulties accessing computer technology independently. For the individual who did not use a computer at the time of interview, further discussion focussed on use of high-tech communication aid equipment.

For a few, (n = 4/28) computers were identified as a specific area of interest, and for some, computer use was specifically identified as a means by which interests were pursued, for example using standard painting and drawing applications (n = 9/28).

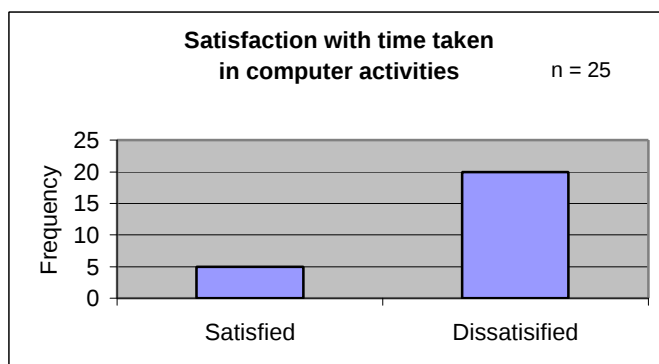
13.1.2 Accessing and using computer technology

When asked whether or not interviewees could operate computer technology independently, 20 (71%), of respondents replied no, they required some form of assistance from a non-disabled person. Of the 20 people receiving assistance in computer use, 10 (63%) reported that they understood how the computer worked. 17 of those receiving assistance were also asked whether or not they experienced difficulties in finding item(s) they needed or wanted on the computer system. Despite assistance, 9 people (53%) reported that they experienced difficulties locating item(s) they needed or wanted.

Typically, those requiring assistance reported that they were dependent on others in supporting *physical access* at the start of a session of use (turning the computer on, plugging in switches, opening particular software applications, setting up the users individual profile of access and use, for example). For those with dysphasia, issues typically concerned competence in mouse and keyboard use.

Interviewees were asked to comment on their experience of computer use with respect to four category variables in use; (1) *time taken in access*, (2) *visual presentation of information* (screen clarity and size of information presented), (3) *navigation /organisation of applications* and (4) *repairing access errors*.

(1) Time taken in access – Of those asked (n = 25), only 5 reported that they were satisfied with the speed of access to computer-based applications. The remaining 20 reported that they were dissatisfied with access speed. Of those who reported that they were dissatisfied, 14 (70%) employed direct methods of access.



Indeed, issues concerned with efficiency and usability of physical access methods features prominently in discussion;

"I cannot move the mouse on the college computer"

"mouse control is a problem"

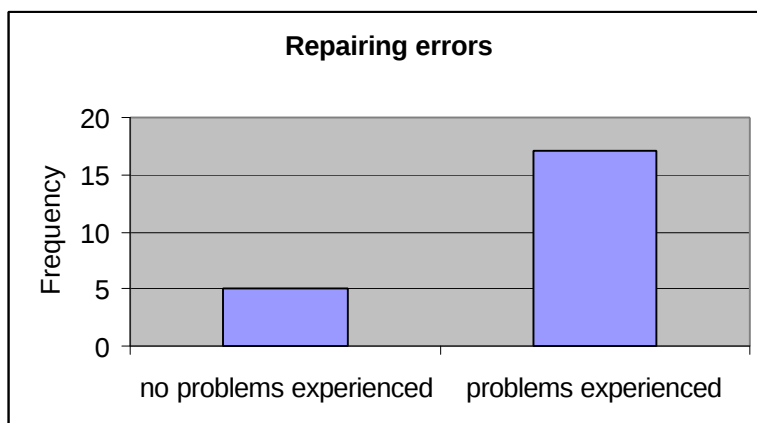
“faster mouse control”

“too many extra buttons on the keyboard”

(2) Visual presentation of information – interviewees were asked whether they experienced difficulties seeing the computer screen when using the computer. Of those asked (n=24), 21 (88%) reported no difficulty with 3 people (12%) reporting difficulties. Interviewees were also asked whether, in their experience, information presented on computer screens was sized appropriately for ease of use. 19 (79%) reported that size was not a problem. 6 respondents (21%) reported that they did experience problems with this aspect of computer use.

(3) Navigation / organisation of applications – of those asked (n = 23), 12 (52%) people reported difficulties in finding their way though computer applications and/or organising files; *“organising files [is] very hard because [it’s] confusing”*
“[I have problems] using and organising discs”

(4) Repairing access errors – users were asked to comment on their experiences of fixing mistakes made when using the computer (pressing the wrong button, for example). Of those asked ($n = 22$), 17 (77%) people reported difficulties sorting out mistakes made.

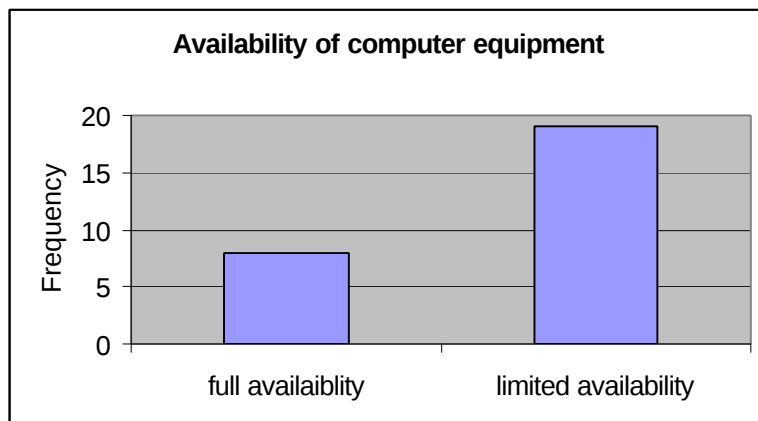


Overall, 14 (61%) interviewees using computers (n = 27), reported experiencing significant problems in computer access and use at the time of interview. Specific problems included:

- ◆ Problems with physical access - switch control and reliability
- ◆ Configuration and set up of systems to users' own particular specifications
- ◆ Integration of AAC system with existing software

13.1.3 Availability of computer equipment

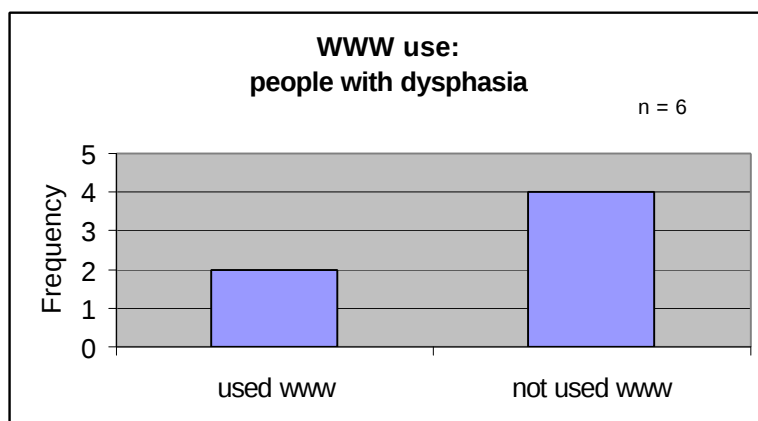
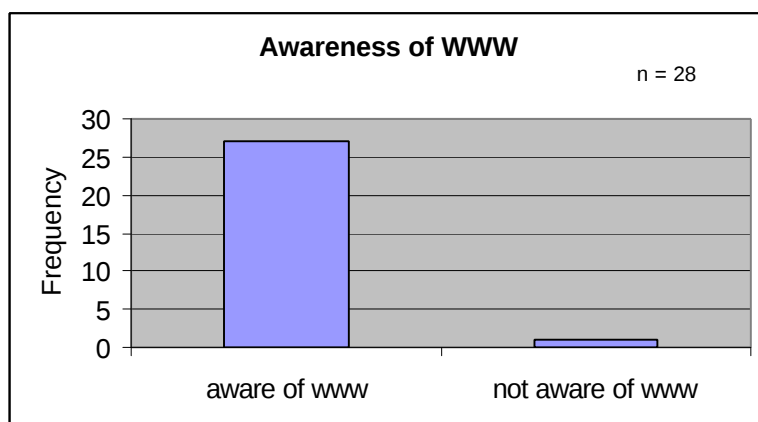
Interviewees were asked whether computers and their experience of computer software met their expectations of use. Of those asked, 12 people (57%) reported that their experience of computer use did not fully meet their expectations, and that computer software typically did not do what they wanted it to do. For most, 19 (70%), access to computers was also limited or restricted.

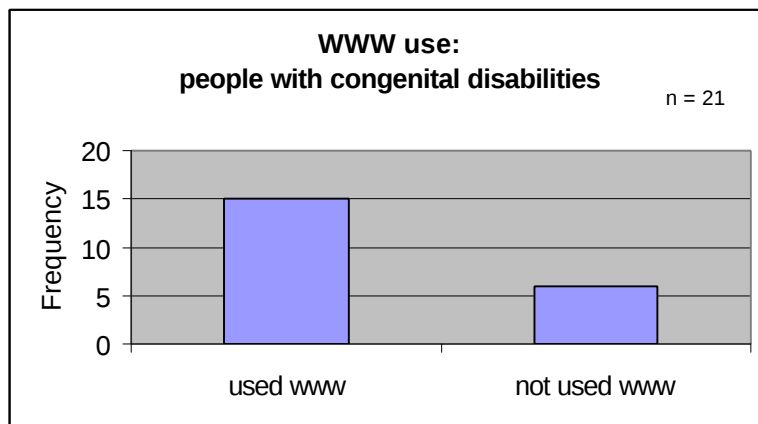


13.1.4 Knowledge and use of Internet Services

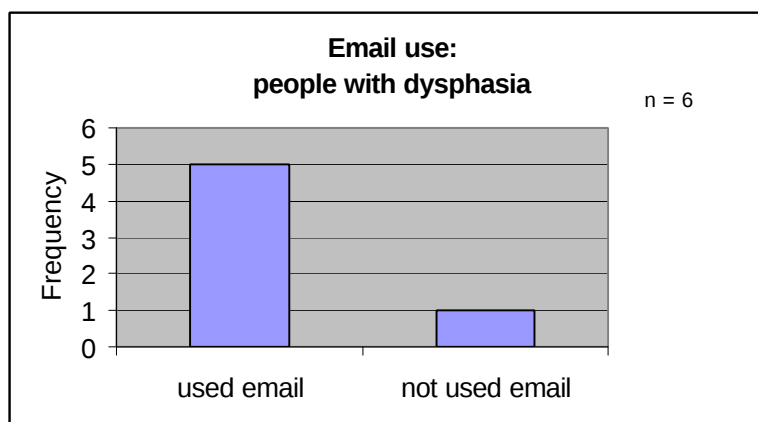
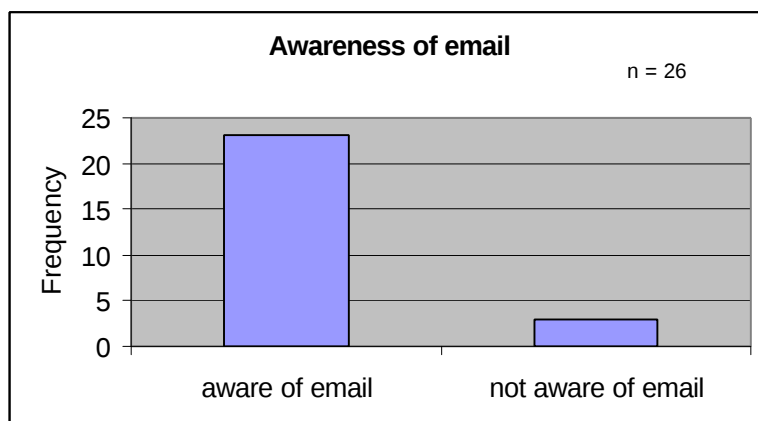
Interviewees were asked to describe and judge their knowledge and use of Internet Services; (1) WWW, (2) email, (3) discussion fora and echat

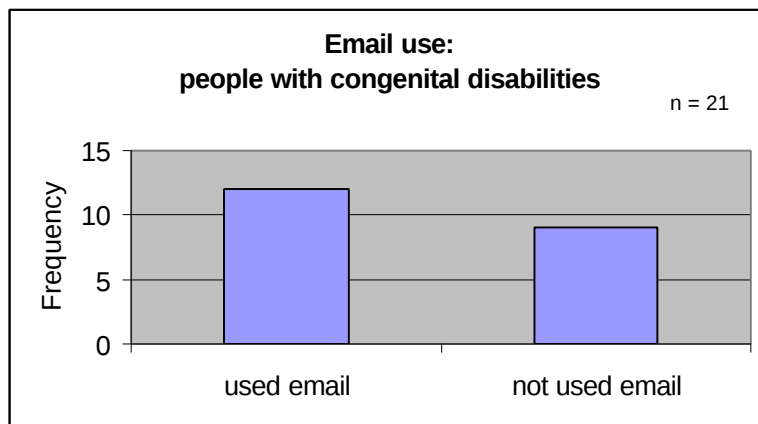
(1) WWW – 27 of the 28 (96%) people interviewed expressed knowledge and/or awareness of the WWW. Of those, 16 (70%) had used the WWW themselves, either with or without assistance. However, this masks some differences observed between populations. For people with dysphasia (n=6), only 2 people (33%) had previously used WWW. Of the population of people with congenital disabilities using AAC (n = 21), 15 (71%) had used the www. 100% of interviewees who had not yet used the WWW expressed a desire to do so in the future.



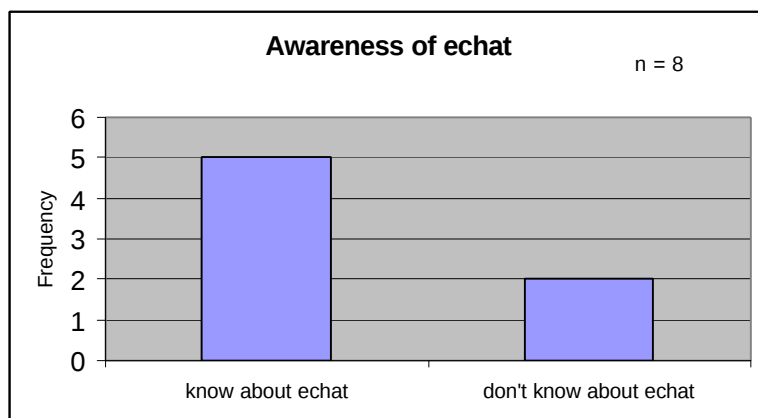
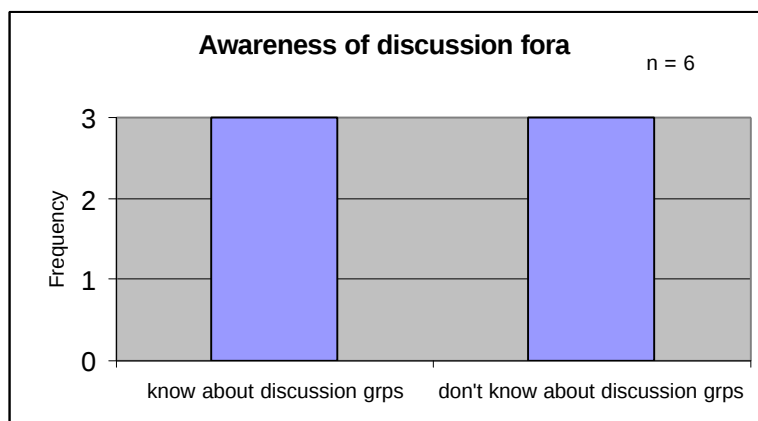


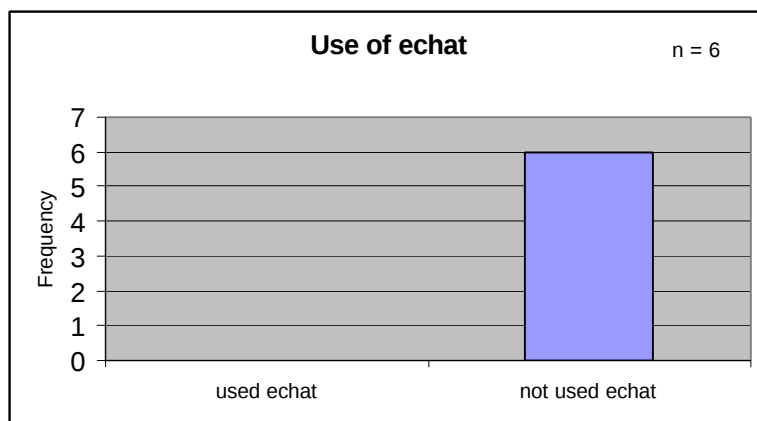
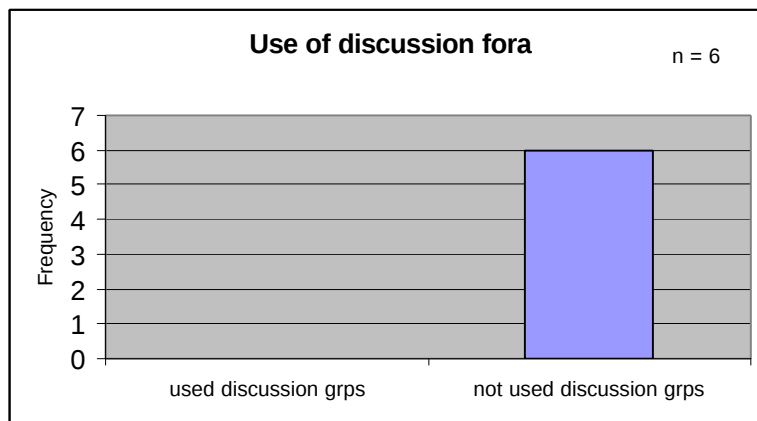
(2) Email – of 26 people asked, 23 (88%) indicated that they know about email, and 17 (65%) people had used it themselves typically with assistance. Again, some variation between populations is observed. For people with dysphasia (n = 6), 5 people (83%) had previously used email. Of the population of people with congenital disabilities using AAC (n = 21), 12 (57%) had used the email. 100% of individuals who had not used the email services expressed a desire to use these services in the future. With few exceptions, interviewees reported that in using email they had dictated their message to an assistant who wrote the email and sent it. Typically also, an assistant read incoming email to the end user. Subsequently, interviewees often expressed frustration concerning a lack of privacy in email use, which for many was not currently possible.





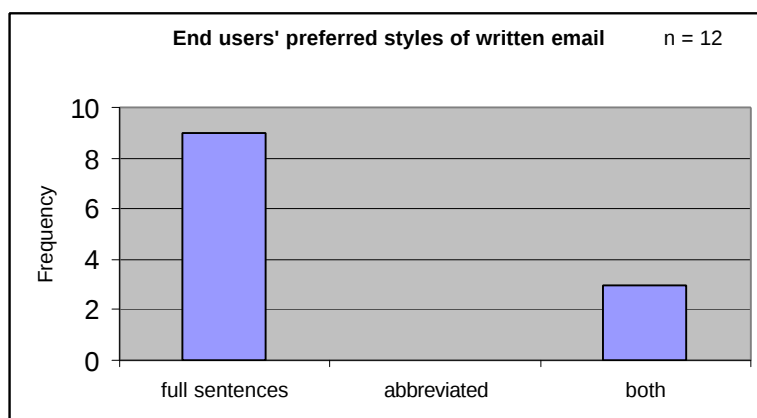
(3) Discussion fora and echat – issues concerning discussion fora and echat were introduced towards the end of the interview procedure. Subsequently, for many interviewees, insufficient time remained for full discussion of these services. Nevertheless, some views were obtained. 3 of 6 people (50%) asked about knowledge or awareness of discussion fora reported that they did not know of these services. Of those who did know of discussion fora, none had used them. Of 7 people asked 5 reported knowledge of echat, however, none had used it. Explanations for lack of use included; time pressure, concern that conversant may be rude, and lack of interest in these media. 3 respondents indicated that they would like to use discussion fora in the future. 2 respondents indicated a similar wish for future use of echat.





13.1.5 Preferred styles of written email

Of the 17 interviewees who had already reported email use, 12 commented on a preference for writing style. 9 people (75%) responded that they preferred to write email using full grammatical sentences / phrases, rather than using abbreviated forms of written expression. No one reported a preferred use of abbreviated forms only, but 3 (25%) people indicated that they used both styles.

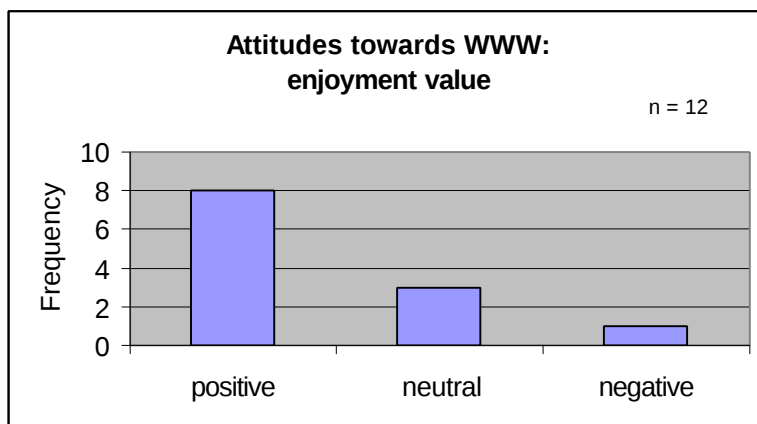
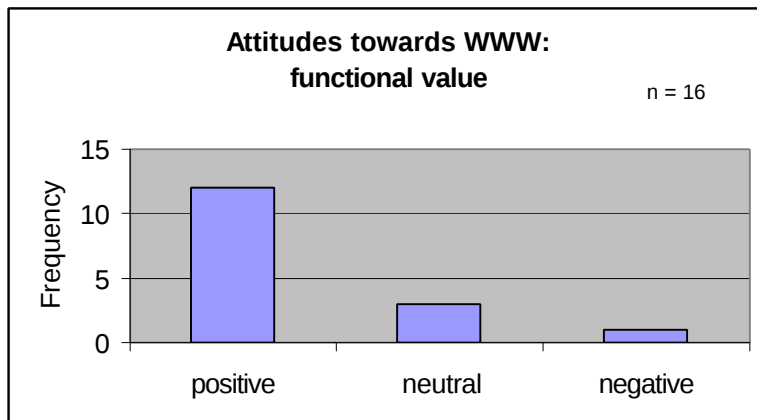


A proportion of interviewees using email were questioned concerning the inclusion of symbols in email messaging. Of those questioned, (n = 8), 5 (63%) reported that they favoured sending text only. The remainder favoured facility to add or remove symbols to messages as they wished.

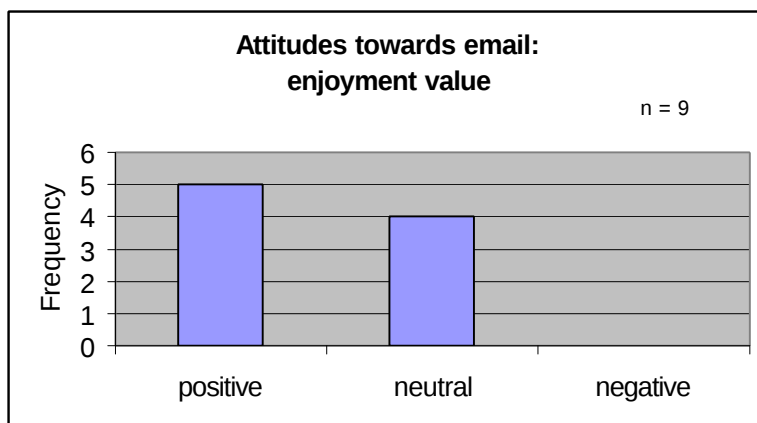
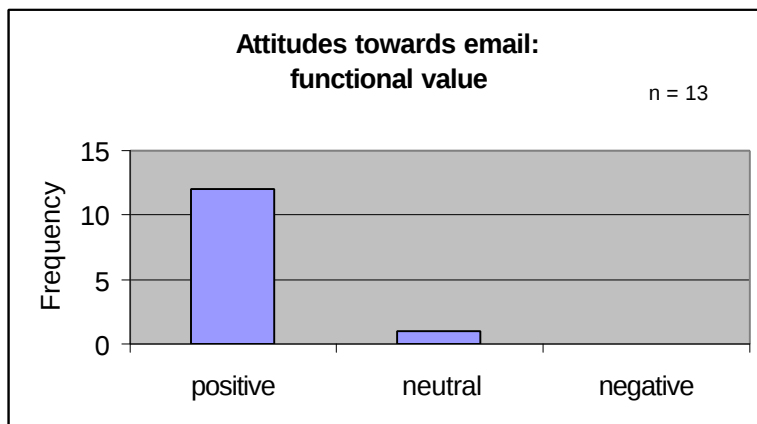
13.1.6 Attitudes towards Internet services

Interviewees were asked to comment on the functional value and enjoyment value of Internet services. Younger interviewees were also asked to comment of the perceived kudos associated with Internet services. Younger interviewees then, were asked to locate a symbol representing the WWW and email on three dimensions presented visually; useful/little use, fun/boring and cool/uncool. The locations of items on the three construct dimensions were coded as positive, neutral or negative.

In general, individuals conveyed positive attitudes towards the functional and enjoyment value of the WWW. One individual's negative attitudes were understood as a consequence of the difficulties he had experienced in accessing and using services.



Fewer people indicated positive enjoyment of email, but did indicate positive attitude with respect to the functional value of email.



Of the younger people questioned on perceived kudos of the WWW and email (n = 7), 6 (85%) indicated that they felt the WWW to be cool. 100% (n = 3) who expressed an opinion concerning the perceived kudos of email indicated positive (cool) attitudes.

14.0 Questionnaire to Service Providers

14.1 Roles and Responsibilities

The service providers interviewed worked with children (including very young to adolescent), adults, or in some cases with both children and adults. Their user groups included those with communication disabilities, many of whom also had physical disabilities and/or learning difficulties. The specific responses from the service providers to describe the AAC user groups with whom they have regular and/or frequent contact with ranged from: Cerebral Palsy, learning disability (both acquired and congenital), autism, head injury, paraplegia and tetraplegia, strokes, progressive neurological conditions (in particular MND and multiple sclerosis), brain tumour, persons with aphasia, severe dysarthria, dysphasia, and dyslexia.

When supporting people using AAC, the service providers work in a variety of different environments: schools, colleges, assessment centres, hospitals, day centres, rehabilitation centres, training homes, regional communication aid centres, and in the client's own home.

The service providers worked in a range of roles. Twenty four interviewees specifically stated that they worked in the implementation and assessment of IT (both hardware and software) and AAC (either low or high-tech communication aids). Training in the use of computers and AAC was also a common role.

Key responsibilities and services provided to their client groups within the field of AAC and IT include:

- providing visual assessment and appraisal of developmental profile
- assessment of AAC requirements, and recommendation of suitable equipment, as part of a multidisciplinary team
- providing advice on the suitability of particular AAC systems
- lending out aids to assess their suitability
- finding the funding to acquire the technology (especially in the case of high-tech)
- advising on available financial assistance
- training and supporting the user, staff, facilitators, helpers, communication partners and family in the use of AAC and IT (both the hardware and software)
- arranging group activities for people with similar ways of communicating
- coordinating appropriate support if unable to provide this oneself
- maintaining and servicing the AAC and IT
- programming the devices
- disseminating information
- developing symbol resources
- adjusting the environment, including reviewing seating, positioning and surrounding noise levels and in summary
- supporting total communication needs.

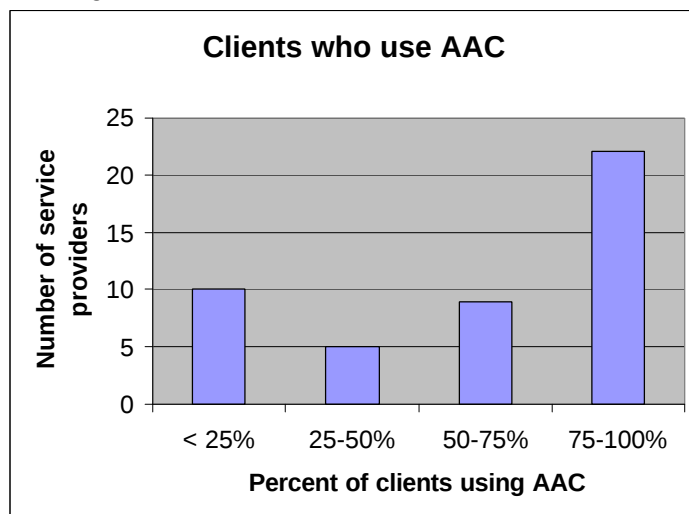
Many service providers had no Web site for their organisation, but 3 said that they were planning one at the moment. The following sites were in operation at the time of the interviews:

Country	Web Sites
Denmark	www.fyens-amt.dk
Spain	www.xtec.es/~esoro
Finland	www.stroke.fi www.kehitysvammaliitto.fi
Netherlands	www.eelkeverschuur.nl www.mariendael.nl www.emiliusschool.nl

	www.arduino.nl www.trappenberg.nl www.rdgKompagne.nl
Sweden	www.hs.se www.kommed.nu (project) www.lu.se (university) e.lio.se\lindah www.kau.se (university) www.dart-gbg.se
United Kingdom	www.grovepark.brent.sch.uk www.acecentre.org.uk www.portland.org.uk www.treloar.org.uk

14.2 AAC users

Service providers estimated that the proportion of people they supported who use AAC was the following:



14.2.1 AAC Equipment Used and Supported

The table below illustrates the wide range of input and output devices used by clients when operating their AAC system.

Input and Output devices used by AAC clients	
Input	Output
Direct access Keyboard settings Switches Speech recognition (DragonDictate) Alternative mouse Keyboard emulator Concept keyboard Flexiboard Touchscreen Eye pointing Big Mac Joystick Step by Step	Speech output Amplifier

The types of AAC equipment that were being supported by the service providers interviewed is represented by the following table. The number of different systems supported will be influenced by the number of respondents from each country; however, the table still provides an overview of the variety of low and high tech systems in operation and requiring support.

Country	Low/light-tech	Communication Devices (+ software)	Other Software recourses	Other hardware
Denmark	Charts /books (Bliss)	Speech-cube PC + Writing to speech software (not named) Word prediction software (not named)	On screen keyboard emulation software (not named)	
Finland	Message Mate Symbol charts & books (pictures, PCS, Bliss, Pictogram) Wordlists Drawing Writing	Easytalk PC + Assistant		
Netherlands	Timetable/day schedule Symbol charts & books Manual signs Drawing Big Mac	Alphatalker Deltatalker Dynamo Tellus + Mindexpress PC + Intellitalk (talking word processor) Agenda with Pictogram My Voice Wizard Mudikom + Symbols for Windows	Symbols for Windows Switch Clicker, Wordbar Boardmaker	
Sweden	Integrated Bliss map Symbol charts & books Manual signs Communication passports Falck devices Eye-gaze frames Big Mac Simple writing devices (not named) Techtalk Parakeet	Macaw Dynamo PC + Talking Screen/Easykeys Infovox 330 Alphatalker Deltatalker Voca Flex Lightwriter PC + Winbliss PC/Cameleon/Norand + Talking Screen PC + WiVik PC + Skriva I Bild Freestyle/Mac + Speaking Dynamically	Bliss for windows Bliss Perfect Clicker 3 Writing with Symbols Boardmaker Lexia (writing training) Kidpix (drawing training) Switch Access for Windows (SAW) Dragon Dictate	Videophone Digital camera
United Kingdom	One step Step by Step	Freestyle/Mac + Speaking Dynamically pro Eclipse	Boardmaker Clicker 4	Sequencers

	Message Mate 4 talk Big Mac Voicebox Talking buddies Symbol charts & books Manual signs Signalong Makaton signs Signed English Objects of reference Etran frames PECS & TEACCH approaches using low tech Communication passport Spokesman	ORAC Macaw Hawk 3 Alphatalker Deltatalker Liberator Pathfinder Vanguard Cameleon + Talking Screen Lightwriter Digimax Dynavox Dynamyte Dynamo Appleton?	Writing with Symbols	
--	---	---	----------------------	--

14.2.2 Symbol systems/sets used by clients

Service providers were asked what proportion of their clients use particular symbol systems. As many respondents found it very difficult to provide specific data, their replies simply demonstrate the wide range of symbol sets used in practice. From the data, however, the following appear to be the most common symbol sets used. It was noted that sets were often combined according to the needs of each particular user. When asked if these symbol systems/sets were typical of the symbols used in their country 41 answered Yes, 3 answered No, and the others either did not or could not reply.

Symbols Sets in Usage			
Country	High Usage	Lower Usage	Other
Denmark	PCS	Photos Rebus	Bliss
Spain	PCS MIC	Pictures/Photos	
Finland	Pictures/Wordlists Bliss	PCS Photos/Pictogram Drawings	Nilbild
Netherlands	PCS	Pictures/Photos Pictogram	Bliss
Sweden	Bliss ⁷	PCS Pictures/Photos Pictogram Rebus	Dynasyms
United Kingdom	PCS	Rebus Makaton Pictures/Photos	Bliss Objects Compic

⁷ it has been suggested that symbol systems used in Sweden may vary according to geographical location. It is possible that these data reflect a bias introduced by the population sampled and their limited geographical lactation

14.2.3 Clients' Level of Literary Skills

Service providers were asked what level of literary their clients were working with by indicating the proportion or percentage in each of the categories below:

- Platform for literacy (using symbols and pictures only, preliterate skills needed before encoding/decoding can begin)
- Emergent literacy (a basic sight vocabulary of a few hundred words without symbol embellishment, and some basic spelling skills)
- Fluent literacy

Many service providers found it difficult to locate a specific percentage within each category, with comments such as:

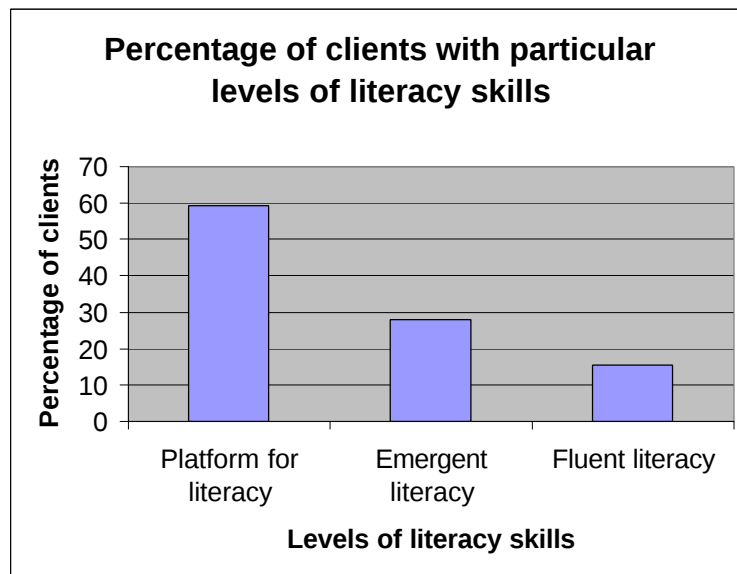
"We see clients with a wide range of literacy skills"

"High percentage of clients have fluent literacy before stroke/trauma. 50% have difficulties, i.e. do not have fluent literacy but do not fit into categories of platform or emergent literacy."

"All levels—cannot really say what percentage."

"Most people with severe aphasia have lost the skill to write, but they might have more skill in reading common, single words – some of them can read quite fluently, but cannot write at all."

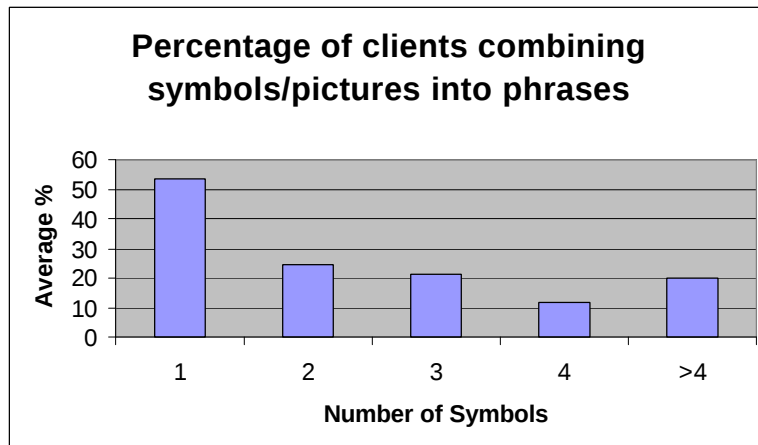
It is also important to note that more respondents provided a percentage for the category of Platform for Literacy (45 service providers), whereas 36 replied to Emergent Literacy, and only 33 provided a percentage for Fluent Literacy, and many of this latter category answered with 0–5%. The following bar chart, therefore, gives a good indication of communication ability of AAC users supported by service providers in this study. However, it was noted by one service provider that the level of literacy was very much dependent on the AAC being used and the communication partner's experience and skill in listening to the AAC user.



14.2.4 Combining symbols/pictures in expressive communication

Service providers were asked the degree to which their clients combine symbols/pictures into phrases in their expressive communication. It is possible that AAC users may produce longer symbol combinations when writing than when in conversation due to the off-line nature of the task. It is difficult to assess whether this off-line nature of writing may be reflected in writing in an email environment. Since the question related to communication rather than writing, it was hoped that the users requirements would be best directed to the nature of the tasks being supported in the WWAAC project.

The degree to which clients combine symbols/pictures into phrases is illustrated in the bar chart below by the average percentages in each category.



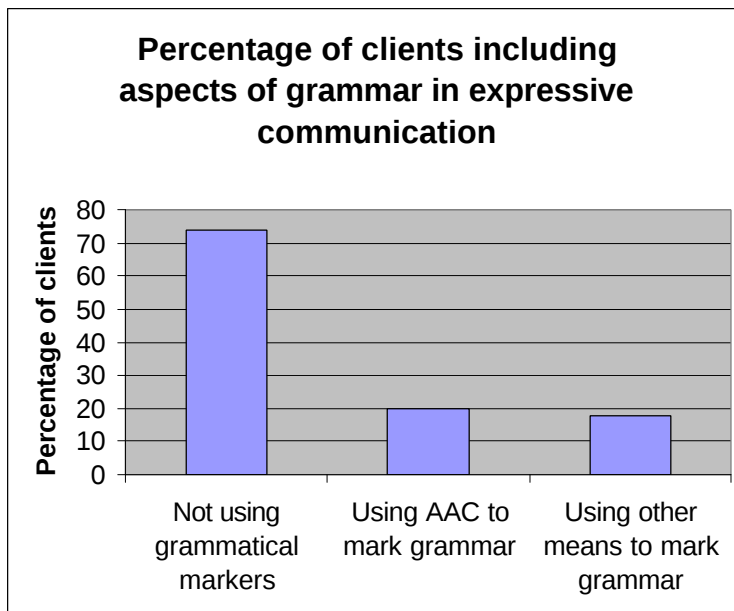
The percentages, however, do not provide a full enough picture of the replies. It is important to note the total number of replies in each category, and the types of comments made by the service providers, clearly indicating that the majority of clients supported by the service providers in this study were typically using only single symbols to communicate. Some service providers were also unable to provide a percentage, and felt it was too difficult to answer this question as they have clients at all levels.

Combining symbols/pictures into phrases	No. of respondents	Sample Comments
Typically using single symbols	43	<i>"The majority."</i> <i>"Most often."</i> <i>"Percentage given is without help; however, with help they can make longer sentences."</i>
Typically combining 2 symbols	33	<i>"Some."</i> <i>"Not much used."</i> <i>"Percentage given is without help; however, with help they can make longer sentences."</i>
Typically combining 3 symbols	26	<i>"Getting less."</i> <i>"Not much used."</i> <i>"Percentage given is without help; however, with help they can make longer sentences."</i>
Typically combining 4 symbols	13	<i>"A few."</i> <i>"Getting less."</i> <i>"Not much used."</i>
Typically combining > 4 symbols	18	<i>"A few."</i> <i>"Getting less."</i> <i>"Not necessarily in a linear order."</i>

14.2.5 Including Grammar in Expressive Communication

Service providers were asked what percentages of their clients typically include aspects of grammar (e.g., plurals, tense markers) in their expressive communication, and their replies are represented by the bar chart below. A number of service providers felt unable to answer this question, however, as their clients skills varied and they functioned at different levels of ability. It was also noted that grammatical markers are not available in PCS, and since this is a symbol set with high usage, one would expect the majority not to be able to use such markers using AAC. The replies therefore simply

give an indication of the abilities and preferences of their existing clients to use grammatical markers at this particular time and stress the level of support that most of their clients require.



14.3 Barriers to AAC use

14.3.1 Main problems when using low-tech communication devices

Before discussing the problems with AAC, service providers were keen to emphasise the positive benefits that AAC brings to users' participation in the learning, communication and self-advocacy. In general, service providers reported that communication aids were highly valued by users, as often their only means of expression beyond gestures and facial expression. Nevertheless, specific types of problems are described below:

14.3.2 Attitudes and expectations

It was noted that low-tech / light tech communication systems require that the communication partner or an assistant to the AAC user is able to read and interpret symbol use, and 'successful' conversation is likely to depend on the skill and the motivation of the communication partner / assistant. Subsequently, the attitudes toward and expectations of AAC, and the communication partners' familiarity / experience in using symbols are understood to impact on their use and effectiveness. For instance, service providers reported a lack of opportunity to use AAC systems in many institutional settings. In addition, despite service providers' perceptions that users typically value their AAC systems, they also reported that AAC use can impact on the users self esteem. For example, Service Providers commented that users may feel childish or uncomfortable using AAC, and that AAC had perhaps limited value in certain environments. For example AAC may have limited value for an ambulant child running around the playground. It was suggested that more effort should be targeted at improving attitudes, expectations and environments that support AAC, rather than focussing on developing AAC users skills.

14.3.3 Unavailable when needed

The AAC system may not be readily available, e.g., it might be kept in a bag, on the back of a wheelchair, it may not be easily portable, or the user might just forget to bring it with him or her. It was suggested that portability could be enhanced by trying to keep materials in the size of A5 folders in order to allow students to more easily carry materials with them.

14.3.4 Difficulties with access

Service providers reported that AAC users, especially those with oculo-motor difficulties, might experience difficulties scanning a symbol chart and choosing the desired symbol. The significant time taken in accessing symbol books, (locating the appropriate page and identifying the symbol), means that sequencing combining symbol sequences into phrases can become a difficult task. Service providers noted that people accessing low-tech systems indirectly surrender some control of the process of AAC use by reliance on communication books being manipulated by a facilitator.

Service providers also reported that listeners may not be able to approach the symbol system near enough in order to be able to see and read messages, and other AAC users may use different symbol sets and lack understanding of their partners symbol based communication. Furthermore, if a number of communication partners are unable to read the symbols, it then becomes difficult for the AAC user to join in group conversations. It was also emphasised that low-tech aids cannot be used to communicate over the telephone.

14.3.5 Wear and tear

Service providers identified the deterioration of the charts or boards, due to ageing, wear and tear and damage caused by spills, as a problem of use. Service providers noted that it is often difficult to find time and resources to make up new charts, especially those which will also have updated vocabularies.

14.3.6 Time/Effort required in use

It was reported that low tech AAC use can demand significant time and effort by both communication partners but particularly the person with a communication disability. AAC use may be more taxing for people with physical / sensory disabilities and for people with learning difficulties. Users general health status may also make it more difficult to sustain the required effort. For example, people with epilepsy may experience reduced levels of concentration and energy as a consequence of drug control of seizures. Service providers expressed concerns that AAC users may be unwilling or unable to expend the necessary time, energy and effort in communicating using AAC. Users may find that the AAC does not give them sufficient control of the interaction, and that it is difficult to put their ideas into action and to interact in a meaningful way using AAC. The communication partner may often ask simple yes / no questions as a faster means of negotiating conversation.

14.3.7 Insufficient or inappropriate vocabulary

Service providers reported that symbol vocabularies are often out of date and need to be updated, improved and customised to the individual users needs. However, service providers complained of little time and/or limited resources to achieve this. Frequently, therefore, a vocabulary may not be relevant to the needs of the user or the user may not be able to fully understand the concepts included in the vocabulary. If however a sufficient and sizable vocabulary is made available, this may impact on the portability of the aid and symbol books can get heavy and unwieldy.

14.3.8 Lack of support

Service providers reported that a lack of support or unimaginative support to AAC users may limit developments in AAC use. Frequent changes in personnel supporting a user are not uncommon and tend to exacerbate this problem and issues concerned with attitudes and expectations discussed above.

14.3.9 Lack in training

Service providers reported that staff supporting people using AAC may have limited insight into the communication needs of those they work with and users and may find it difficult to understand their restrictions. Learning Support staff in schools and care staff in residential homes may have little or no training in the use of the systems, they may be unfamiliar with symbol systems used and have few opportunities to support their use. It was suggested that staff should be trained in the use of communication aids on an everyday basis, supporting the principle that AAC is a central and essential aspect of communication and participation in society. In part this could be accomplished by

encouraging the carers to be more proactive, i.e. initiating conversation with the aids, and getting staff interested in using the communication devices as an integrated part of education.

14.3.10 Lack of enthusiasm from supporters

It was suggested that motivation is linked to understanding, and without such understanding the facilitator often did not have the motivation to provide enough support in using the aid. It was suggested that parents often see a communication aid as a picture book and therefore do not use it to best advantage. Parents may feel that their child is able to communicate very well at home, and they are not aware of the frustration when their child goes outside. As students get older, it was suggested that parents often see a greater need and hence wish to see communication skills developed further.

14.4 Main problems when using high-tech communication devices

The problems cited for low-tech communication aids were also mentioned for high-tech devices. However, additional difficulties were as follows:

14.4.1 Technical problems

Technical problems identified by service providers' focus generally on electronic breakdown. A lack of robustness was also documented with high tech devices being vulnerable to shocks, bumps and falls. Additional problems include broken or vulnerable wires and faulty switches along with poor battery life, and the need to recharge the battery on a regular basis. Systems were also considered to be unreliable, temperamental and inconsistent. Low sound quality was seen as a problem, often with quite or unclear speech output, particularly in noisy environments such as a classroom. The length of time experienced in the repair of technical difficulties was also understood to lead to frustration particularly for the user who may be unable to communicate fully during this time.

14.4.2 Lack of funding

Lack of funding can affect not only the purchase and implementation of suitable devices, but also the ability to provide the expertise and training for those who must set up, program, implement and repair the systems. In the UK, it was noted that the cost of funding the repair is usually covered by parents, schools, or social services. However, it was also noted that funding was needed for the parents, teaching staff, etc. to learn about the systems, as they themselves might need to do the programming. Lack of funding was identified as a particular problem for adults with acquired communication disabilities, where there is a lack of the educational initiatives and resources in this area.

14.4.3 Interface problems

These included reflections and readability of the screen when using the device outdoors, especially in bright environments. Also noted were difficulties with an interface that is not intuitive and is difficult to learn. Lack of screen space to organise and group possible options was also cited as a problem along with big, square, ugly buttons for access.

14.4.4 Inappropriate technology

Service providers reported that, on occasion, inappropriate technology is recommended following assessment. In addition, recommendations and support that is available may not meet the user's changing needs. Some service providers working with clients with significant and complex needs expressed disquiet at unrealistic expectations concerning the potential benefits of AAC for the individuals they support. It was suggested that professionals who recommend high tech AAC devices are not those who work with clients on a long-term basis and in everyday life, and a high tech AAC device does not always solve that everyday communication problems.

Some service providers expressed concern that high-tech devices did not give sufficient benefit to the user when compared with the effort in their use. That is, the cost (time, energy and so on) in use does not relate favourably with the likely benefits of use. There appears to be an over exaggerated belief that high tech AAC devices will solve many problems.

14.4.5 Unavailable when needed

Easy portability may be a problem with high-tech aids and availability of communications aids impacts directly on the communication recourses of the individual (for example, either the device is not with the user, or not turned on when he or she wants to communicate.) Transporting and using AAC safely in certain circumstances (e.g. in the rain or over uneven ground) was also reported a difficulty. The weight of the devices (particularly for ambulant users) and the suitability of wheelchair mounting facilities were also identified as important issues to consider. In particular, limited integration of AAC devices into different settings, e.g., in home and classroom, meant that system availability tended to be context dependent. Interestingly, it was noted that AAC is generally used as the main form of communication in work and school settings and when training in their use with speech and language therapists. AAC was used little or not at all in other non-supported environments.

14.4.6 Difficulties with access

As with low-tech aids, access problems were reported for users with physical or visual disabilities using high-tech devices. Service providers reported that people with learning difficulties were likely to experience difficulties locating desired vocabulary when using AAC devices with multiple layers of vocabulary.

Identifying reliable switch access options for people with physical disabilities was considered a significant barrier to AAC use. Limited independent control over operational aspects of AAC use (turning the device on and off, for example), were identified as problems for many users. Reducing the number of switch hits to activate any symbol was seen by many as a priority in AAC use.

14.4.7 Time/Effort required in use

The time and effort needed to learn how to use high-tech devices is high and arduous. Use of the device can be very slow. Even if the software and hardware are suitable, operational aspects of use (e.g., scanning) are by their very nature can take considerable time. Service providers report that this aspect of use can be frustrating for both user and listener. In addition, some systems can take a long time to boot up, while others are complex to program which results in infrequent updates to vocabulary.

14.4.8 Insufficient or inappropriate vocabulary

As in the case of low-tech systems, service providers reported that relevant vocabulary is often lacking in high-tech devices. Systems are often complex and time consuming to program, compounding difficulties in keeping devices up to date with vocabulary, pre stored sentences / phrases and stories.

14.4.9 Listener's lack of familiarity/experience with the system

Service providers reported that listeners might find the synthetic speech unintelligible, particularly if they are unfamiliar with the device. As discussed earlier some people, including family members, may also have unrealistic expectations about what can be achieved with advanced technology.

14.4.10 Lack of support

Service providers reported that those supporting and working with AAC users are often not sufficiently confident in the use of high-tech communication devices and therefore not able to provide the required assistance to the user. Lack of support was identified as either (1) lack of staff skills or (2) lack of time and funding for staff to support the user adequately. Similarly services providers identified limited time for necessary technical repairs.

14.4.11 Lack in training

Service providers indicated that training in high tech AAC for those supporting and working with AAC users could be problematic. Such training requires those supporting and working with AAC users to have more technical insight and knowledge to understand and facilitate AAC use. Service providers recognised that training was required not only in the programming and technical aspects of AAC support, but also in strategies to facilitate and support communication using high tech AAC. With new

products constantly appearing on the market, service providers reported that it is also difficult and expensive to keep up to date and maintain the necessary expertise.

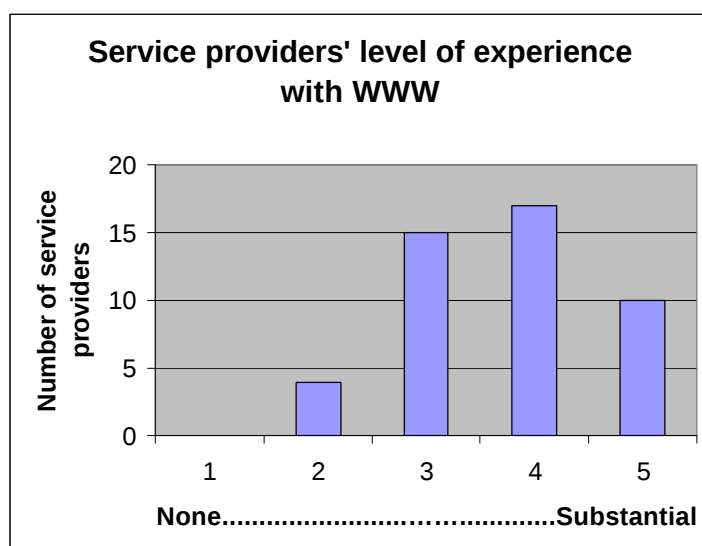
14.4.12 Lack of enthusiasm from non-disabled communication assistants

As with the low-tech aids, service providers were concerned that AAC users are not always encouraged to use the high-tech devices. Service providers identified lack of motivation and enthusiasm and lack of understanding and possible fear of new technology as variables impacting on AAC use.

14.5 Service Providers' Experience of Internet Services

World Wide Web

A high proportion of the service providers interviewed reported moderate or fairly substantial experience using the World Wide Web. The Web was used at home and/or at work, for work and for personal use (e.g. finding sites relevant to speech and language therapists, technical information on computers and aids, leisure, shopping, obtaining flight, train and hotel information, and in 3 cases even developing their organisation's own Web sites).



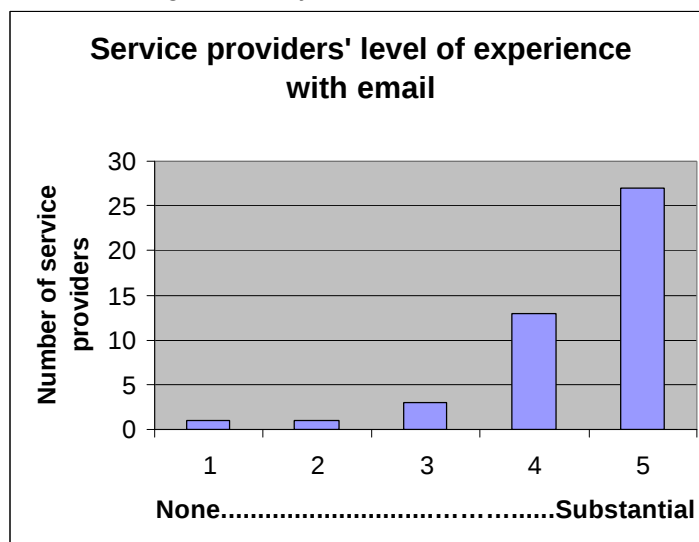
When asked to name sites they were aware of that dealt with AAC issues, the following were listed:

AAL list	Danish Handicap Institute
AbilityNet	David Beokelman's site
ACE Centre	Handicom
Acoling	Handikappinstitut (Sweden)
Aculog	ISAAC at www.isaac-online.org
ATA Access	Kompagne
BECTA	Liberator
Blissymbolics Communication home page	Links via www.lburkhart.com/links
CAC	Major Johnson
CALL Center	Maketon site
CASC pages	Meldich Manor
	National exhibits

CAST Closing the Gap's home page Commercial sites (e.g., Mayer-Johnsson, Handicom, Gewa, Brooks, CompAid, Modemo, Sunrise Medical, etc.) Communication Matters at www.communicationmatters.org.uk Computerbility CORE (Edinburgh) CORE Centre CSUN's home page	National organisations and associations like Aphasia Association Pages for topic vocabulary, e.g., world wide wrestling children's ITV Project websites (Kylestad for instance) Toby Churchill Trace Center at trace.wisc.edu/ Widgit www.hmi.dk www.kommed.no YAACK
---	--

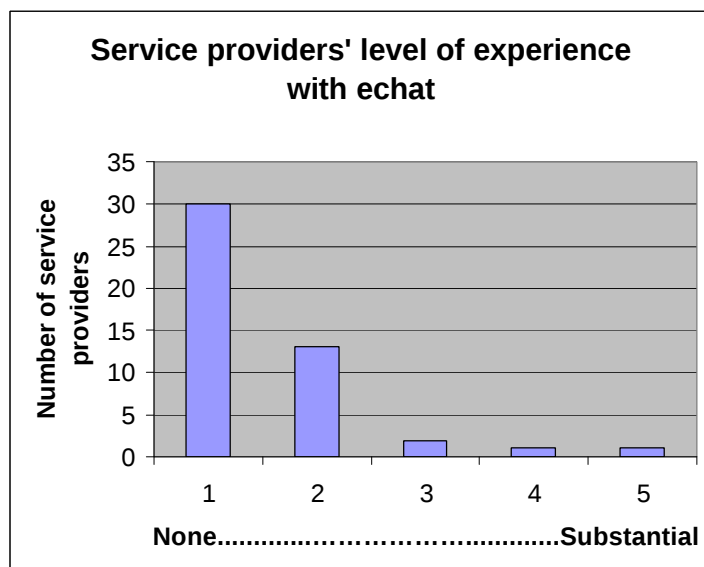
14.6 Service Providers' Experience with Email

Most service providers had substantial or fairly substantial experience using Email. Those using email did so daily or nearly daily, at work and/or at home. Email was being used to send messages and data files to colleagues, friends and family, and comments indicate an enthusiasm for communicating in this way.



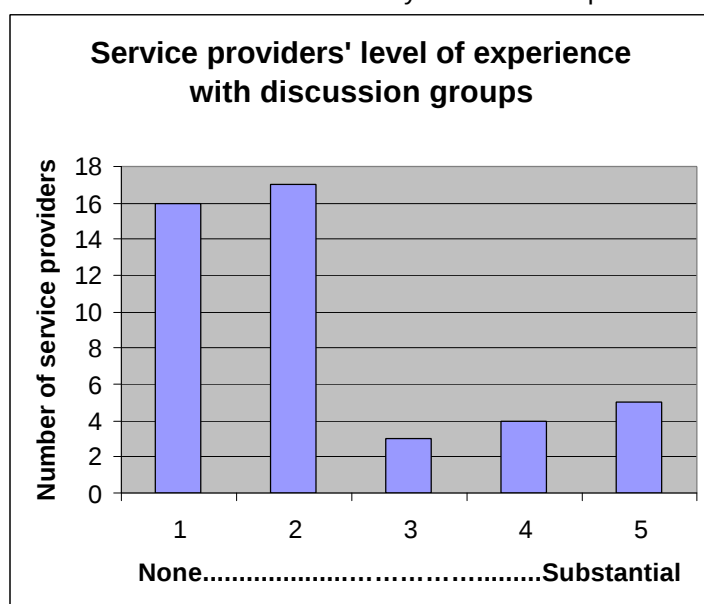
14.7 Service Providers' Experience with Echat

As can be seen by the bar chart below, few service providers had experience using Echat. Lack of interest, lack of time, and lack of motivation were cited as the main reasons for non-use.



14.8 Service Providers' Experience with Discussion Groups

Most service providers had little or no experience using Internet discussion groups, although 9 people in total did have substantial or fairly substantial experience in this area.



Positive reasons for using discussion groups were given as:

"Invaluable resource when well subscribed and organised."

"Very helpful in particular relating to voice recognition and SEN/disability/technology issues."

"I am a member of forums related to my area of work and interest."

Negative reasons for not using discussion groups were given as:

"Logged on to some but got flooded with too much irrelevant information so logged off."

"Don't have the time or inclination."

"Reading a few groups, but not active in writing."

"Know how to use it, but don't have time for it and don't need it."

14.9 Clients' use of the Internet

Service providers were asked whether or not any of their clients (AAC users/people with aphasia) were using internet-based services, e.g. WWW, Email, Echat, Discussion groups. 32 service

providers answered Yes, and 10 answered No, with 1 answering Maybe and another indicating Not Yet.

The proportion of clients using Internet services varied considerably (range 1-100%, median 9.5%). This variety in range was understood as a function of clients' abilities and availability of technology and support either at the school or at home. The low median suggests limited use. Indeed 18/23 respondents reported that less than 10% of their clients were using Internet-based services. Specific comments indicated that most, if not all, clients who used these services could use them only with assistance.

The types of services being used by clients, (almost always with assistance), included:

email, www, echat, text messaging, discussion group and newsgroups.

Typically, those using email were using standard applications and dictating messages to non-disabled assistants. Service providers understood echat to be particularly problematic for AAC users due to the real time demands of the media. However, they also recognised that AAC users themselves may perceive this differently.

One respondent also said that: *"for those with dyslexia, however, echat was more common, but not for persons with aphasia."*

Flexibility in email use was identified with one end user sending e-cards using PCAD, typing her own name with 1 word or greeting, rather than using traditional text based messages.

Service providers indicated the end users were using Internet based services for the following activities:

Use of Internet-based services	
In general:	Particular interests:
Communication	Hobbies
Getting information	Sports
Fun/leisure	Science, art and music
Homework/research to school curriculum	Trains
Socialising with friends, especially for those who are at home all day.	Information about their illness/devices
Contacting people with similar conditions/ exchanging experiences	Barbie.com
Reading the news/keeping up to date	Environmental issues
Replacing the telephone	Transport/train schedules
Paying bills	Tele-banking
Sending mail to government agencies	Planning trips/tourist attractions
	Booking tickets
	Contributing to internal newsletter

14.10 Clients' problems in using internet-based services

It was noted that people with communication disabilities suffer the same problems as other users when using new technologies, for example forgetting how to perform an infrequent activity. However, their particular problems in using internet-based services can be classified under the following themes, all leading, in most cases, to an inability to use the services independently.

14.10.1 Time

Users' difficulties with literacy mean that it can take considerable time to create a message. Considerable time is also required to set up the necessary adaptations, e.g., switches, to optimise access.

14.10.2 Expense

The high cost of telephone bills was stressed, as users, particularly those using indirect access techniques, are likely to access services relatively slowly and hence spend a long time 'on-line'. In addition, the expense of required adaptations and software was noted. It was anticipated that the introduction of wide band may reduce overall monthly costs to users. .

14.10.3 Physical access

Difficulties in efficient switch access to Internet services and limited adaptations for switch users were one of the most commonly cited problems for people within the target population. It was noted that Internet searches and/or email messages are usually conducted / constructed by an assistant with the user taking a more passive role in Internet use, simply being presented with the results of a search, for example.

14.10.4 Lack of appropriate software

Service providers reported that end users do not have appropriate software to access Internet services independently.

14.10.5 Technical support and training

Service providers reported that those providing IT support require considerable training with regard to the hardware and software being used and the adaptations required. Those working to support end users also required to be aware of methods and strategies in adapted computer use and have an understanding of the principle aspects of Internet services. In addition, staff and family, and user motivation was seen as a key aspect for Internet use.

14.10.6 Information presentation

For users with limited literacy skills, text based information is usually unobtainable without text to speech support. Service providers cited no other means of supporting symbol users access to web based information. It was noted that visually complex pages often containing much information and/or with fast moving animation, and/or music, was potentially very confusing for users, particularly those with perceptual difficulties and/or learning difficulties.

14.10.7 Cognitive demands of Internet services

Learning system use was identified as a potential problem for people with learning difficulties. Email and WWW addresses were thought to be difficult to remember and to use. Similarly as mentioned above it may be difficult for many users to interpret and understand the structure of a Web pages and identify the particular information required.

14.10.8 Use of specialist software

When asked whether their clients were using any specialist software for computer access and use, 16/32 replied Yes, 15/32 replied no, and 1/32 said that it depends on the client. The range of software packages in use in the countries involved in the interviews is listed in the following table.

Country	Software packages in use
Denmark	Magic Cursor Dragger Headmouse Tracker 2000 Quick Glance Cyberlink Vital WiViK
Spain	SAW Voice synthesis and voice recognition
Finland	SAW-program (to write ready made sentences) ARNIT's FlexIt and Darnit Screen magnifying software Screen readers
Netherlands	PILOOT (under development for symbol email) Bliss for Windows Onscreen keyboards
Sweden	Skriva I bild Blissmail (Furuboda) – not yet complete Delta Talker with Widget WiViK Clicker (for adults) MindExpress Writing with Symbols

United Kingdom	Discover switch/screen Lotercamm Inter_Comm HandsOff (keyboard emulator) Writing with Symbols Widget systems WAACIS software (less now than previously) Special access programs e.g EZ Keys, WIVIC Lunar MG1-5 Link for the Liberator Cameleon EZ Keys Texthelp Clicker 4
----------------	---

14.12 Use of PC adaptations

When asked whether their clients were using PCs adapted in any way (e.g., switch), 24/33 replied Yes and 9/33 replied No.

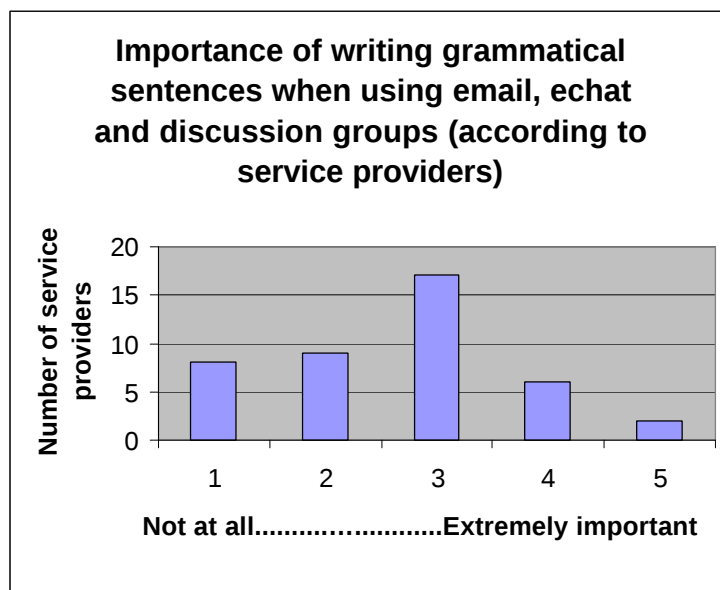
Adaptations in use in the countries involved in the interviews are listed below. Only 1 service provider stressed that his/her users were accessing the computer using standard hardware.

- Discover:switch/screen
- Switches, including headswitch, footswitch
- Alternative mice, including Rollerball, Trackerball, Joystick
- Single-handed keyboard
- Expanded keyboard
- Concept keyboard
- Touchscreen
- Keyboard emulator (those using Liberator)
- Computer/switch tweaking to give mouse movements/clicks
- Head 'infra red' panter for speech output
- Serial keys (using their communication aid as input)
- Special access facilities on the PC such as sticky keys, high visual contrast, mouse keys
- Webracer (VOBIS)

14.13 Language Use

14.13.1 Importance of writing grammatical sentences

Service providers were asked how important it is for AAC users to write using grammatical sentences when using email, echat and discussion groups. Service providers usually felt this very much depended on the client, the particular task and the users perception of recipient of the message.



Specific comments included:

"It depends on other users."

"Grammar is important if you want to make an unambiguous expression."

"Depends on the level of acceptance and insight of the patients. Some find it very important to use correct spelling. For most, grammar is less important."

"Don't know – this group of AAC users is too mixed. For people with cognitive impairments, it is not important."

"Not important if communicating with someone of the same level."

One comment in support of the importance of writing in grammatical sentences, it was emphasised that grammatical sentences are particularly important to literate partners.

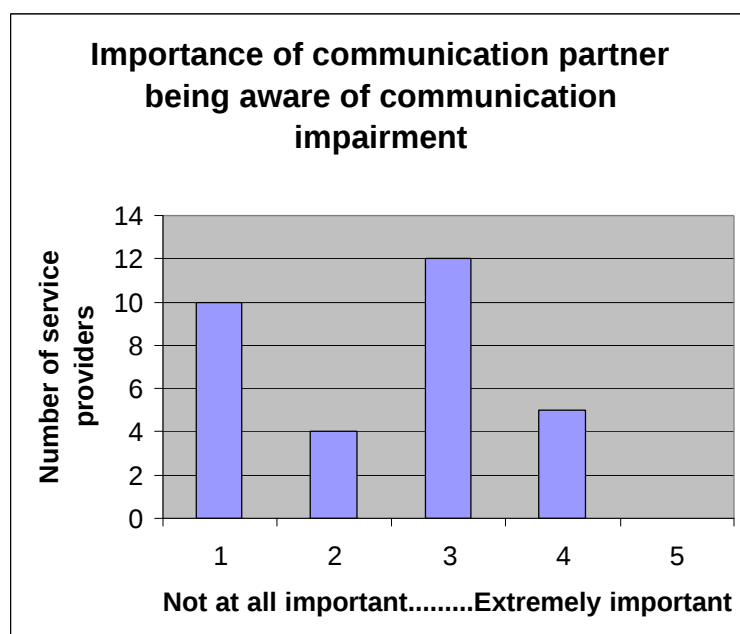
14.13.2 Use of simplified forms of expression

Service providers were asked if they believed that simplified forms of expression are sufficient, e.g., telegraphic writing. Most respondents (33/39) felt that simplified forms of expression are sufficient. Only 2/39 said No, and 4/39 said that both types of expression are important.

It was felt by many respondents that whatever works most efficiently should be used, as long as basic information/keywords/symbols are present and the content of the message can be understood. A comment was made that *"all email is telegraphic to some extent— why single out the disabled?"* A decision to use simplified forms of expression is dependent upon the individual user and the conversation partner. A decision is likely to be made in response to a number of factors including correspondents' familiarity, what needs to be said and the abilities of both the AAC user and the conversation partner. It was noted that for international purposes, ability to understand the content would be optimised if the sentences are simply constructed. It was also suggested that it would be beneficial to use alternative strategies to increase the complexity of the message rather than trying to use grammar, and that perhaps telegraphic writing is better than bad grammar. It was felt, however, that the users would prefer to produce complete sentences.

14.13.3 Importance of communication partner being aware of communication disability

The service providers were asked how important it is for a symbol user that a conversation partner over the Internet is not aware that he/she has a communication disability. As can be seen by the bar chart below, more people felt that it was either not at all important (1 on the scale) or were unable to answer either way (3 on the scale). 10 respondents simply did not wish to reply to this question, saying that it very much depends on the individual user and the nature of the communication— however, it was important that the user be given the choice.



Comments in favour of informing the communication partner suggested that being a successful AAC user was something to be proud of. It was also clear that misunderstandings can arise as a result of a communication disability and knowledge of the disability might prevent this happening. Being open about one's disability would also enable the user to reach people with a similar way of communicating and with similar problems.

Comments against informing the communication partner included the fact that some users may fear prejudicial treatment and prefer to be seen on the same level as everyone else. Furthermore, the Internet is anonymous and people with disabilities can appear as non-disabled people with all the attached benefits.

14.14 Barriers to Internet Usage

Issue	Number
Lack of expert support (support needed for AAC specialists as well)	14
Language and learning difficulties	10
Difficulty of use (lack of understanding for cognitive impaired)	9
Basic physical access (switch interfaces etc)	8
Cost of access to Internet—computers, telephone usage, other service costs	6
Lack of non reader and symbol friendly sites	6
Lack of knowledge of what is available, and what technology can offer	6
Computers being available for use by user	6
Lack of useful and appropriate software	4
High levels of support needed for usage (day to day operations)	4
Understanding the concept of the Internet	4
Shortage of text to speech support and features	4
Motivation to use (providing activities that make the net interesting and useful)	4
Slow access speed for user to operate systems	3
Lack of funding for technology	3
Symbol based e-mail systems are restricted—problems with using different symbol systems; lack of basic software	3
Lack of communication partners with the same software	2
Effort involved in use—physical, psychological	2
Software compatibility for symbol use	2
Fear of technology	2
Matching communication devices to the Internet technology	2
Supporting individual clients with different and customised symbol sets	2
Remote communication is a low priority—face to face more important	2
Lack of support for symbol users, and in tailoring systems to individual need	2
User friendly switch interfaces needed	2
Setting up the features needed—lack of supportive software e.g. Set up Wizards	2
Lack of basic literacy skills	2

A revolution in symbol and picture use is needed	
Empowerment of users is necessary to find out what they want	
Lack of 'hot key' features for assigning functions to keys	
Support not being funded by care organisations	
Packaging symbol based information (translation is not sufficient)	
Lack of privacy for users wanting to use communication systems	
Scheduling computer use into other teaching activities	
Human support may always be needed to interpret messages	
Some communication still needs to be face to face.	
Lack of graphic symbols to support WWW usage	
Need to ensure communication partners does not need specialist software as well	

Clients' problems in using Internet-based services (see earlier section) have resulted in barriers to the use of the Internet in the future. The results indicated that the most significant barrier to Internet usage by those with communication difficulties was a lack of support in using such technology. This encompassed a variety of difficulties including both the setting up and use of computers, as well as simple access to services. The cost of computers and paying for access time to the Internet were also seen as significant barriers. Where computers were used, unassisted use was rare, and for this reason AAC specialists and others supporting the person with communication difficulties were seen as a primary target for such support initiatives.

For end users, a difficulty in understanding how to use such products was a common problem, and even basic physical access created problems for many users. Many users have multiple disabilities and those with communication problems were also likely to have problems with keyboard and mouse usage. It was also noted that the dedicated communication aids used by clients often did not easily interface to PC's.

In addition to problems of basic physical access, it was also reported that there was a lack of appropriate software for symbol users to access the Internet and e-mail, and that there was also a lack of symbol friendly sites. In addition there was some concern raised that there could be a lack of communication partners using the same software, which would reduce the value of any e-mail services. Some concerns were also raised that symbol based e-mail could be restricting, particularly as symbol sets were often tailored to the individual. It was therefore unclear whether some clients could ever use such systems unsupported, as some interpretation of messages might well be needed. Additional concerns raised were that communication via these means would be slow, and there would be considerable effort involved. Remote communication was also seen as being a lower priority than face to face communication.

14.15 Future Use of Services

Issue	Number
Keeping in touch with friends/family	29
Obtaining Information (general, hobbies, interests)	23
Shopping	10
Entertainment	9
Making new friends and pen pals	5
Education	5
Contacting clients support groups	4
Paying bills/banking services	4
Video-telephony	3
News	3
Booking services	2
Contacting other schools	2
Playing games	2
Symbol based WWW sites	
Booking holidays	
Writing letters	

Keeping in contact with therapist	
Giving information	
Travel Information	
Downloading and watching films	
Music	
Job seeking and employment	
Dating	
Sport	
Work	

Notwithstanding these barriers it is encouraging that keeping in touch with family and friends was identified as a major use for such services in the future. Making new friends and contacting support groups were also seen as likely application areas. Obtaining information and access to services via the Internet were also seen as useful future applications, with entertainment, shopping, and home finance being seen as significant future services. Whilst education was explicitly mentioned by a small number of respondents, this did not come across as the most significant future applications for Internet based services with these groups. Given that those interviewed were primarily speech therapists and other service providers, this lack of emphasis on education is revealing, and suggests that the Internet will play a minor role compared to more conventional means. This may also be a reflection of the relatively low use and knowledge of computers by these groups of service providers.

Whilst video-telephony was also suggested as a future service by a minority of respondents, there was no clear evidence that this was a service that would add appreciably to the value of computers and Internet usage. Two respondents explicitly stated that they could not see a need for such services.

14.16 Further Services/Developments Needed

Issue	Number
Speech output e.g. embedded control elements for speech synthesis software (also issue of different national languages being supported)	9
Symbol based e-mail with agreed standards	8
Simple e-mail services (set up wizards as well?)	6
Improved accessibility to conventional Internet services	6
Simple WWW browsers (issue of entering WWW addresses in particular)	5
Simple WWW sites	5
Symbol translation systems (symbol to text)	4
Dedicated simplified symbol access software (browsers, email)	4
Switch accessible WWW browsers	4
Short, simple text on WWW sites	4
Speech Recognition (also issue of different national languages being supported)	4
Video-phone/webcams	4
Symbol friendly WWW sites	3
More symbol based sites	3
Sites that show how others are using computers to support autonomy	2
Auditory prompting—Talking help facilities	2
Developing core symbol vocabularies for these applications	2
Developing simple form filling applications	2
Software to automatically simplify text materials	2
Matching individuals personal communication strategies to the technology—and personal symbol sets	2
Simplified search engines	2
Automatic symbolizing of keywords	
Develop simple and switch accessible applications	
Develop symbol prediction software	
One integrated software package allowing input from a range of devices	
Allow users to select from a range of layouts	
Making plug ins such as FLASH accessible	
More websites for disabled people	
Screen reader software	
Integration of communication aids with PC software	
Services that maintain face to face contact	
Providing a good alternative to mouse/pointer input	
Chat rooms for symbol users	
Easier ways to send pictures	
Marking keywords on sites clearly	
Tools for creating easy access WWW pages	
Developing symbol vocabulary for WWW use	
Better access for motor impaired	

Word/sentence prediction software	
Symbol based word processors for Bliss	
Services giving further independent and choice	
Sites providing links to other resources	
Use of large graphics	
Avoiding excessive moving graphs and animation	
Sites with symbols rather than text	
Fun education sites for symbol users	
Developing user friendly software for carers as well as users (setting up services can be difficult)	
Functional activities to extend users concepts of the Internet	

A variety of suggestions were given as to the types of services and developments that were needed. The most common was the need for good text to speech systems that would read email and WWW pages to those with communication problems. There was a perceived need for integrating speech output into the applications, and this would involve being able to control the speech output from within the application i.e. having embedded control elements. Audio prompting i.e. talking help facilities was also suggested for applications. Whilst video telephony or web cams were suggested by some of the respondents, in general they did not come across as being seen as a high priority for development. However it was also reported that there was a need for easy ways of sending pictures.

The most significant volume of comments received related to the development of WWW services, and the need to both develop more symbol based sites, and to improve access to more general sites by symbol users. Speech output was one mechanism for achieving greater accessibility, but in addition there were a variety of other ways in which access could be improved. Simplified WWW browsers for symbol users would be particularly useful, also with an emphasis on limiting the need for entering WWW addresses. Such software should also be accessible by switch users. Simplified search engines were also seen as being needed. A core symbol vocabulary for WWW use was also seen as being needed.

A variety of recommendations were given for improving access. Recommendations were needed to ensure that short and simple text was used on WWW sites and that keywords were clearly identified. One suggestion was to have software that would check the complexity of any language used and simplify it. Another suggestion was that software could be developed that would automatically symbolize key words on a WWW site. Recommendations were also needed on the use of graphics on WWW sites, i.e. size of graphics, and also their dynamic aspect i.e. avoiding excessive moving graphics and animation. Concerns were also raised about ensuring that WWW sites containing plug ins such as FLASH were accessible to symbol users. Note—also this same issue would apply to the use of Java script or Shockwave extensions as well.

The development of symbol based email services was suggested as a future service, and it was recommended that this also include Wizards to support the setting up of the services. It was argued that in addition to developing standards for symbol sets to be used for these applications, it was also necessary to develop symbol-based software allowing access to the services. Symbols to text translation systems were also suggested as being important to develop in this context. The issue of using individuals own symbol sets in such communication was also raised, and some concerns were raised regarding the feasibility of developing translation systems that could account for such idiosyncratic use. Whilst symbol translation from one system to another was mentioned, no explicit mention was made of the need to translate symbol sets from one countries language to another. Other suggestions were to develop symbol based word processors and symbol prediction software.

In addition to these comments there were also a range of comments relating to a need to improve access to technology by switch users, and finding suitable alternatives to mouse and other pointers. One suggestion was to make more use of speech recognition systems, but the issue of lack of support for some national languages with existing technology was also raised. The lack of integration of some communication aids with PC's was a cause for concern, and it was also suggested that integrated software solutions were desirable rather than users having to operate a variety of different software.

Comments were received about the need for more symbol-based sites, and sites that demonstrated how others with communication problems had made use of computers. A need was identified for entertaining and educational sites for symbol users, and providing links to other resources in this area.

14.17 Guidelines to Improve WWW Design

Thirteen of the sample reported that they were aware of guidelines to improve WWW design for people with communication problems. These were:

BOBBY	http://www.cast.org/bobby/
AWARE	http://www.aware.hwg.org
W3C	http://www.w3.org
WATA	http://www.wata.org
Unknown	http://www.accessibility.nl
Unknown	http://www.irv.nl
Unknown	http://www.dremplesweg.nl
ARNIT (Symbol based e-mail)	
Nordic Guidelines for Accessibility	
Swedish Handicap Institute	
ACE Centre	
TeleMate project	
Meldreth Manor School Site	
Ability Net	
SENCO Education Forum	

14.18 Guidelines needed

Response to this question varied considerably. The following describes areas where development is needed.

Issue	Number
How to simplify text , grammar etc. e.g. highlighting key text	9
How to set out visual displays to avoid distraction due to clutter—also appropriate use of animation	6
Guidelines on setting up switch accessible applications	5
Strategies for navigation—reminding users where they are and have been	2
Guidance on the use of symbols versus text	2
Guidance on size and appropriate use of images	2
Guidance on setting up text that is easy for speech synthesizers to use	
Ensure WWW designers have some symbol training—its not a simple translation task	
Provide information on the design implications of different communication problems	
Give information on how to get access to symbol banks	
Make symbol banks available	
Provide guidance for WWW designers in dealing with cognitive issues	

These suggestions reiterate some of the needs for further developments already listed, and it is clear that recommendations on how to simplify text on WWW sites are needed. In addition the issue of layout and use of graphics is seen as being important to address, particularly in relation to the size of images and the use of animation. Advice on making WWW sites accessible to switch users was also seen as being needed, and in addition to the issues of physical and sensory access, cognitive issues were also raised e.g. simplifying materials and providing navigational cues to users to assist them in using a site.

Guidance for WWW designers on how to use symbols versus text was also seen as being needed, along with developing the resources that would be needed e.g. freely available symbol sets and the design implications of disability. A word of caution was also expressed however, as it was suggested that developers would need explicit training in the use of a particular symbol language in order to make effective use of those symbols on their WWW site. This raises an issue of whether it is

reasonable to expect a WWW designer to be able to take these issues into account without expert support.

Some answers to this question were related to guidelines that were already known, and found to be useful. These are listed below.

Issue	Number
Clear and uncluttered layout	4
Simple language	4
No moving text/images	2
Easy to read screens for those with a visual impairment	2
Ensuring people with communication problems have a say in development	2
High Contrast colour for text/background	
Colour cuing	
Links with useful names	
Non reliance on images	
Text only versions of sites	
Using large targets for selection	
Being aware of access issues for keyboard users	
Allowing more time for communication	

14.19 Other ways of improving access to the Internet

Issue	Number
Having specialist IT trained people to support clients and care workers	3
Money	2
More access to computers and Internet	2
More training of staff on the Internet, symbol based WWW sites and email	2
Dedicated hardware for accessing the Internet	
Time	
Free phone access for disabled	
Providing a range of symbol system options on a WWW site.	
Exploring different design options for symbol based sites.	
Make computer access integral part of life skills training for these groups of clients	
More access to broad band transmission	
Work spaces for disabled people in Internet Cafes, Libraries etc	
More information in one's own language e.g. Dutch.	
Having the right kinds of access tools e.g. Text Help.	

Very few additional issues were raised, but the importance of ensuring specialist IT training available was reiterated. Staff responsible for supporting clients with communication difficulties need to understand how to set up and use computers, how to access e-mail and the WWW. They also need to become familiar with using specialist software designed to support the clients. Having the time and resources to achieve this is likely to be a significant challenge, along with ensuring that there is sufficient access to computer technology and the Internet. Access to high speed communication infrastructures at a low cost is a necessary prerequisite, along with the necessary software tools and hardware adaptations to make access possible for symbol users. The range of disability that needs to be accommodated is also broad, covering users who cannot read, may also have sensory and motor disabilities and often learning difficulties. Accommodating such a wide range of possible users will prove to be a significant challenge, and a careful focussing of the attributes of the primary users will be needed to ensure that the project objectives are met.

15.0 Questionnaire to Manufacturers

15.1 Products developed/distributed

Four of the companies appeared to be involved primarily in the development and distribution of dedicated communication products, whilst the rest of the sample included developers and distributors of software packages and adaptations to promote PC access by people with disabilities. These companies' products were primarily designed to operate in the Windows environment (ranging from Windows 95, 98, 2000 and NT). However, one manufacturer has been a specialist with Macintosh products for many years but also uses Windows. One respondent also includes CE in their software platforms.

15.2 Main target groups

The majority of the sample explicitly identified people with physical and communication disabilities as being their primary target group, but in addition the cognitive impaired were also identified as being important. It also appears that many saw their products as being targeted for use in an educational setting.

15.3 Use of products

Although there is a great deal of overlap, the respondents indicated that their products were being used for the following range of activities:

- Communication
- Writing
- For speech output
- Developing language and communication competence
- Training, compensation, and exercising pre-school skills
- For personal use
- For use in school
- As alternative and tailored educational resources
- As therapy
- For environmental control
- For PC access, as alternative access and control

15.4 Products involving use of WWW or email

7 out of 10 respondents said that their products involved the use of the WWW or email and allowed the user greater ease in operation these functions. Three companies said that their products did not directly involve the web but could facilitate access. Products which can be used for other text-editing can also be used with the Internet and email, such as 'Write N Speak', which reads from the source of text to the screen, [www.scripttalker](http://www.scripttalker.com), and on-screen keyboards and special keyboards like Flexiboard with pictures or symbols.

Packages facilitating access to email and the WWW using symbol and speech support include: SymbolMail, Bliss for Windows, Skriva I Bild, Clicker 3-4, Widget 2000WWS, SAW (alternative and tailored input to standard browsers), and Multimedia Lab V (for the production of tailored accessible educational exercises that can be published on the web), etc.

15.5 Future Developments Needed

Although some of the companies did not want others to know what their latest developments are, others were more open with their ideas and offered the following possibilities for the future:

- Software should become more symbol based
- Flexible communicating through different groups across the world
- Swedish version of Mind Express
- Small portable touchscreen PCs with AAC software to replace some of the dedicated communication/speech devices
- New features to promote access to computers e.g. improved mouse features

- Internet services need to be more accessible along with mobile communications
- Translation systems for symbol use, i.e. symbol set to symbol set.

Other issues raised

- The close involvement of other companies working in this area was needed, and this should take place as early as possible in the project. A full co-operation and encouragement with developers will maximise accessibility to target groups
- Access to symbol sets through a common site or portal.
- Basic access problems will need to be dealt with first (motor and cognitive).
- The issue of individuals having customised symbol sets will need to be considered

15.6 Problems that clients have when using their products

Seventy percent of the sample reported some awareness of problems that clients had in using products. Basic access to the technology was difficult for those with motor disabilities, and there were also problems in understanding both the software and the instructions on how to use it. Learning to use software was seen as a critical issue for those with problems with cognitive problems. Getting others in the person's environment to take an interest in communicating with them was also seen to be an issue, and technology was often poorly configured. Users were dependent on care staff being motivated to use the communication devices and in setting them up for them.

Some concerns were also raised that devices themselves were less than perfect, with poor quality and amplification of speech output being a cause for concern. Screens could also be difficult to read due to poor clarity and insufficient contrast, and this was a particular problem in bright daylight or sunshine. Some problems with initial software installation and configuration were also identified, with some processor/mother boards also causing problems for some software.

Note—patch available from Microsoft to deal with some of these problems.

One company commented that there was a potential problem in trying to develop a central place for people to download symbol systems. Many companies are distributors of symbol systems and expect clients to pay for the use of specific symbol sets such as PCS. We need to see that those who sell these systems continue to get reimbursed for them. Also to get reimbursed for updating with new symbols, etc.

15.7 Promotion of services on the WWW

Only one company did not promote its services on the WWW. The URL's of the other companies are listed below:

www.rehabmodul.se
www.abhh.dk
www.rdgkompague.ul
www.kmd.ul
www.kmdev.com
www.gewa.se
www.sensorysoftware.com
www.sih.se
www.frolundadata.se
www.prentromint.com

15.8 Awareness of guidance/guidelines to create web pages

Seventy percent of the sample were aware of guidelines to make WWW pages more accessible, but it was clear that these related to general accessibility issues rather than being specifically for those with communication problems. The Swedish Handicap Institute was cited as a source of information (Laromedel guidelines?) along with the W3C initiative, Trace, Bobby and Microsoft's own development guidelines. Guidelines were identified as providing support for mainly visual impairments rather than of cognitive aspects.

15.9 Guidelines/guidance need for designing usable WWW pages

Respondents were asked what guidelines/guidance they would like to see in order to create WWW pages so that they will be more usable by people with communication problems. Their replies were as follows:

- Simple guidelines: Important aspect of this might be guidelines for speech support, tailored search functions/engines, simplified content and interaction models
- Baseline WWW templates to work from and implement with your own material
- More support for symbols/icons-translation of different symbol languages.
- Simple to use guidelines for motor disabled and symbol users
- Guidelines to simplify presentation and navigation, making pages simple and easy to use, i.e. easier navigation, bigger buttons, etc.
- Text speech engine for all (languages?)
- Conversion system to change web pages making them more accessible. Filters, converters to convert existing pages into more accessible pages for users. (Adapted browser) + HTML editor HTML editor

15.10 Awareness of standards used in the development of AAC

Half the sample were aware of standards for the development of AAC devices, and one source of information identified was the Swedish Handicap Institute (See (www.hi.se)). Note that this may also be a reflection of half of the sample being Swedish companies. Other sources of information on standards were identified as being a draft ISO for the coding of Bliss symbols (BCI), and M3S for wheelchair and other control applications. Technical standards were more common than software standards and included EMA—Electromagnetic compatibility, CE—Conformity, and standards for Medical Safety Compliance (ISO).

15.11 Developments needed in standards to support advancements in symbol-based communication aids

The development in standards that these companies feel are needed are:

- Simple concept codes for symbols (like Blisscii) using codes of limited length and complexity, i.e. 3 letters 3 digits. These codes with corresponding symbols should be on a central server. Note that there is a need to allow free access to different symbol systems but this conflicts with the commercial aspects of developing and selling products.
- A standard for translation between different symbol sets and transmission of symbols between different users.
- A meta language for symbol use.
- Standards for translation and interaction between users of different communication systems need to be developed based on Bliss, PCS, Pictograms, Rebus, digital photos, etc
- Note—defacto standards often emerge, and are developed by the manufacturers.

15.12 The future for web access

All of the companies saw a future for WWW access with AAC devices using symbols and it was ranked as the most likely development for use in AAC.

It was noted that the user should have simpler devices and programs with integrated support activities. Making WWW sites more accessible to AAC users was seen as a particular challenge and was an exciting opportunity. The issue of symbol access was also raised, with one suggestion being that symbols should be centrally located on the Internet so that they could be downloaded as needed. It should also be possible to pay the developer before you download such symbols if payment is required.

15.13 The future for email

All of the respondents also saw a future for e-mail access with symbol users, as such technology increased a user's independence from others being needed to support communications. It was ranked as the second most likely application area for use with this user group.

15.14 The future for e-chat

The majority (80%) also thought there was a future for e-chat with these user groups, but there were more concerns regarding possible speed of communication and the cost of providing access to such services. It was also ranked as the least likely area for development compared to WWW access, e-mail and discussion groups.

It was seen as being of a lower priority and probably limited to the much more able with relatively good text comprehension. Language could also be a problem, and would be facilitated by having automatic symbol translation. E-chat was not identified as being the highest priority for development.

15.15 The future for discussion groups

The majority of the sample (90%) saw that there was potential for discussion groups for symbol users, and was better than e-chat as people would have time to compose their answers. It was ranked as the third most likely application area for development after WWW access and email.

It was noted that discussion groups already existed in this area, i.e., Minspeak Conferences, PEC (Pittsburgh Employment Conference) and the THF in Sweden (for persons with speech disabilities). However some concerns were raised that this could be difficult to use for many symbol users and that in addition symbol translation would be needed for such services.

15.16 Role of mobile phones or (PDAs)

Respondents were asked what role they thought mobile phones or personal digital assistants (PDAs) might play in this process. There was quite a varied response given to this question, as it seems that there is a lot of uncertainty regarding the role that mobile phones are going to play in e-mail and Internet access in the future. Note that one respondent thought that the use of SMS (short message service) could grow as a useful application with these groups of users.

Currently PDAs are too poor for operation with these groups due to:

- Small screen size (and resulting symbol size)
- Small operating buttons
- Poor graphics and sound/speech
- Low levels of robustness
- Short battery life, etc

Internet access via these kinds of devices is also currently slow using mobile telecommunications technology. Note—this a short term limitation as broad band wireless communications will come on-line in the near future.

16.0 User Requirements Summary

Issues	General Implications	Specific Implications for WWAAC
Internet services in their infancy in this sector.	Training and support are critical.	A high degree of training and support needs to be provided. The application itself should be supportive, e.g. in the form of a set up Wizard.
High degree of AAC use in this sample.	Target audience shows a requirement for the software being developed.	Sample is representative for WWAAC and is interested in and able to work with us. Note: sample reflects high end of expressive and receptive abilities
Integration of high and low tech aids.	There will be a need to be able to download/print out symbols from WWAAC to symbol charts.	Ability to use symbols from WWAAC in symbol charts, etc., needs to be fully integrated as part of the interface, e.g., a symbol-based print facility.
Existing software focuses on basic physical access.	Physical access issues are critical in this sector.	Where existing alternatives cannot be easily used WWAAC software needs ensure most advantageous access options (e.g. scanning interface, mouse alternatives, Non-reliance on scrolling windows and click-and-drag applications, etc)
Majority of AAC users will require adapted PC's.	Need to be able to able to accommodate a range of needs.	WWAAC developments should adopt Microsoft accessibility standards, e.g., serial keys, non-reliance on mouse input device.
Compatibility of AAC with PCs.	Hardware from AAC and PC needs to interconnect. Software also needs to have common interchange formats.	Need to ensure that dedicated AAC devices integrate with WWAAC software
Variation in the use of AAC from organisation to organisation and from country to country.	Importance of interconnectivity is emphasised.	WWAAC project developments should integrate with all AAC devices and systems available currently available to end users.
Host language support of software packages.	Language support is needed both in terms of the software and with regard to speech output facilities.	Need to decide how many different language versions of software to develop and also whether other elements such as speech output are currently adequately supported.

Multiple disability/physical disability prevalent.	Need to accommodate a wide range of disabilities.	WWAAC software needs to accommodate access by people with a range of disabilities. This also has implications for setting up services, and coping with multiple users of software.
Multiple users of software package likely.	Adaptability/flexibility in the design to accommodate individual users.	Ability to set up user profiles and defaults for individual users. Possibility to store your personal set-ups and transfer them from one computer to another.
Major symbol sets PCS, Bliss and Text.	Priorities for symbol translation can be established.	Priorities for symbol translation in the WWAAC project are: PCS ? Bliss Bliss ? Text PCS ? Text
Majority of AAC users have only low platform for literacy.	Majority of AAC users have low levels of expressive ability.	It is anticipated that potential users of Internet services will be those with personal skills, interests and abilities to carry out tasks required in accessing and using Internet services. Individual motivation in the use of services is identified as important in the use of WWAAC products. For this reason a large potential market for WWW access can be anticipated, and we need to decide on our development strategy.
Majority of users use 1 symbol at a time.	Same as above.	Same as above, plus the use of email is not excluded for those with limited expressive abilities. WWAAC needs to consider ways in which pictures and graphics can be send within the body of an email.
Majority of users do not use grammatical markers.	Same as above.	Same as the above two points

General barriers to AAC use / low and high tech		
Time / Effort required in use.	Need to adapt/customise interface for user needs.	Include typical scanning support facilities (e.g., type-ahead facility). Consider the range of possibilities within language support options . Echat is not seen as a priority service because of the time required to compose/type a message.
Unavailable when needed.	Need for portability.	Consider potential of WAP and PDAs for the future. Possible integration of wheelchair controls with AAC and computer access.
Difficulties with physical access.	Need to be able to accommodate a range of physical disabilities.	Offer a range of different access modes. i.e direct and indirect access Consider voice recognition as an input device for some users. Access must be possible without the use of the mouse. Non-reliance on scrolling windows and click-and-drag applications.
Insufficient or inappropriate vocabulary.	Need for adaptation/customisation of symbols to suit users' needs, and development of new vocabularies.	Facility to adapt/customise/add symbols to database set (from paper through scanning, from computer, etc.) Have an agreed interchange format to transfer symbols from existing device or medium. A centralised symbol database is essential and prioritised
Listeners lack of familiarity / experience with the system	Need to ensure communication partners are aware of language support strategies.	Code of Practice should include protocols/strategies on message construction and use of Internet technology by people with communication disabilities.
Lack of support	Support is critical for both users and facilitators.	Ensure support to both user and facilitator is part of the offering.
Lack of training.	Training is critical for both users and facilitators.	Provide training, in the cost of the product, to both the user and facilitator.

Lack of enthusiasm from supporters.	Need to 'sell' the product to those who are likely to purchase it.	Provide 'added value' support and training for facilitators (e.g., demo versions). Have a good, accessible, rich web site for WWAAC to advertise/entice users and facilitators.
Specific barriers to high-tech		
Technical problems.	System needs to be reliable.	Important to ensure reliability with switch control, etc. May also want to consider tutorial software to assist in support activities.
Complexity.	Simple and easy to use.	In addition to products, configuration/setting up needs to be as easy as possible ('idiot-proof') with full support. Use of Wizard, help facility, etc.
Lack of funding.	Decision needs to be made as to what price the market will accept.	Make modular usage possible (e.g., being able to purchase only a simple browser as part of the package). Exploitation Plan needs to investigate this further.
Inappropriate technology / matching to user needs.	Need for flexibility/customisation and trial usage.	WWAAC could provide a tutorial tool to assist users in developing internet access skills . Offer a demo disk or 30-day trial. Ability to purchase a 'package of care' as well as the software. Avoid use of dongles.
Interface problems: input / output.	Need to accommodate a wide range of disability (physical, sensory, communication, cognitive).	Provide facility for alternative input/output modes. Access must be possible without the use of the mouse. Non-reliance on scrolling windows and click-and-drag applications.
Specific physical / cognitive / sensory access problems.	Same as above.	Also needs to interface with adapted hardware, etc—support for serial keys.
Specific support required.	Same as above.	Expert support required for hardware and software related issues.

WWW and email use with service providers reflects common trends in the population.	Trends for increased use of WWW and email are expected to continue in the future.	Key services for WWAAC should be: 1. WWW (for both information provision and interactive services, like home shopping, home banking, etc.) 2. Email
Echat and discussion groups – less usage, also reflected by wider trends.	Same as above.	Following WWW and email, the next order of priority for WWAAC applications are: 3. Discussion groups 4. Echat
Generally low client use of the Internet, and in general its supported use.	Whatever use of email is made is generally to family or for Intranet use. Priorities are for facilitating local or national communications. AAC users interviewed by WWAAC may not be particularly representative but they have had exposure to the Internet and have enthusiasm to use the technology. AAC users interviewed by WWAAC were generally those with high receptive ability and high expressive ability. This makes them atypical of the wider AAC user community. Even with these users, supported use is more common than full independent operation.	Low priority for translation between different EU languages. The target users for use of the WWW will be those with skills and motivations to conduct tasks required by WWAAC. Target users of email may be those with limited expressive skills as well as those competent in expressive use of AAC systems Our project objective should be to promote independent use where possible. (This would also support the Security/Privacy issue below)
Security/Privacy for users of Internet	AAC users should have the same rights to Security and Privacy as the more able population.	Project's goal should be to provide independent use of the Internet for AAC users. Dealing with a vulnerable group may raise particular issues regarding security. Security issues need careful consideration with regard to interactive services/e-commerce.

General problems in clients using Internet-based services		
Time needed to operate equipment.	Techniques to speed up access need to be explored. Need to adapt/customise interface for user needs.	Include typical scanning support facilities (e.g., type-ahead facility). Note: Real time Echat is not a priority because of the time required to compose/type a message.
Expense.	Long connection times on the Internet can be anticipated.	Techniques to reduce on line time need to be explored, e.g., automatically caching frequently used sites, use of macros, etc.
Physical access.	Need to be able to accommodate a range of physical disabilities.	Offer a range of different access modes. Access must be possible without the use of the mouse. Non-reliance on scrolling windows and click-and-drag applications.
Lack of symbol based sites.	There is a distinction between symbol-friendly sites and those developed for symbol users.	Project needs to develop guidance for both developing symbol-friendly sites and those developed specifically for symbol users. Priorities need to be decided. Will Web Authoring Tool (WP7) target both these types of sites?
Lack of information.	Need to increase the level of information on available services.	User support needs to be proactive. Develop a very good WWAAC information site
Training.	Training is critical for both users and facilitators.	Provide training, in the cost of the product, to both the user and facilitator.
Language problems.	Need to accommodate language difficulties.	Need for simple use of language, clear terminology, etc. Project needs to investigate whether specific WWW requirements for AAC users will conflict with those of other disability groups. Guidelines need to ensure that design of software will be optimal for AAC users.
Perceptual problems.	Need to accommodate perceptual difficulties.	Need for adjustability in size and type of fonts, colours, etc. Allow images to be scaleable.
Cognitive problems.	Need to accommodate cognitive difficulties.	Allow easy facility for error correction. Need for limited information on a page, grouping of information, etc.
Unclear as to whether user wishes communication	Each individual has his or her own preferences for how they present themselves in the e-mail and discussion groups.	Provide option to send just text or text+symbols.

partner to be aware of his/her disability.		
Future use of Internet services appear to require email information and interactive facilities.	Security/Privacy issues need to be investigated with interactive sites.	Establish what level of priority should be given to interactive services in WWAAC development work. Evaluate the degree to which any WWAAC browser can be used with interactive services.

Further Services/Developments needed: Questions for Discussion		
How to integrate the activities of this project with W3C	Unclear as to whether an effective contribution will require membership of the W3C	Consortium needs to discuss how best to influence W3C activities.
What proportion of the national populations are AAC users?	Statistics are needed in order to identify potential markets for products and services	The potential market size is a critical issue for planning exploitation activities, and also in developing priorities for development.
What proportion of AAC users will be served by the product?	Criteria for selecting appropriate users is important	Need to determine whether WWAAC is targeted at a sub sample of the AAC population, and how to assess whether an AAC user is likely to benefit from WWAAC.
Data indicates that Win9X and 2000 needs to be supported, but should we be looking to the future as well i.e. Whistler? Use CE for portable devices?	Selection of supported platforms critical	Consortium needs to decide which systems should be supported in the future, and whether to also include other platforms in addition to Windows.
Minimum specification of PC to support these products?	It is known that this sector may be using relatively old and low specification PCs	Consortium needs to confirm minimum specification for: CPU, hard drive, RAM, CD Rom, sound card, video card, operation system (lowest Win95?) and internet access.
Is there a need for conformance to any other standards in software development, e.g., Bliss standards?		Consortium needs to agree software and hardware standards.
How can we facilitate use of symbol banks / codes which are copyright (licensing, payment when downloading?)	Copyright issues are seen as being critical in symbol use.	Consortium needs to decide how to facilitate symbol to symbol translation. The issues of ownership and copyright are critical and licensing agreements need to be considered as soon as possible. There is also a need for agreed and standardised codes to represent icons in order to facilitate symbol usage in the WWW and e-mail services.

How will services be implemented (on individual PC or centralised server i.e.portal)	Issues of copyright, updating symbol sets, etc., when based on a local machine	Whole issue of translation, extending symbols sets, etc., needs to be considered here.
Are there other spin-off applications from WWAAC, e.g., chart-making facilities, a system for dealing with scanning/digital images, etc.	Issue of how to integrate image manipulation with WAACC. Need for drawing package, scanning images into WAACC, printing images out etc.	Need to identify the boundary to any WAACC product. What exactly will be developed in the project, and what will be provided by 3 rd party software. How to transfer information from one application to another is also important to consider, e.g., WWW page to email, adding images to email, printing images from emails, printing images from WWW pages, putting images into drawing applications etc.

References

- Aicardi, J. (1998) *Diseases of the nervous system in childhood*, 2 edn. London: Mac Keith Press.
- Basil, C. (1992) Social Interaction and Learned Helplessness in Severely Disabled Children *AAC Augmentative and Alternative Communication* **8** 188 – 199
- Beresford, B. (1997), *Personal Accounts: Involving disabled Children in Research*. York: Social Policy Research Unit
- Beukleman, D.R. and Miranda, P. (1992) *Augmentative and Alternative Communication: Management of Severe Communication Disorders in Adults and Children*. Baltimore: Brooks
- Brewer, J, and Dardallier, D. (2000) Web Content Accessibility Guidelines: Implementation, Promotion, Future Development, Presentation to the 15th Conference on Technology and Persons with Disabilities, California, March
- Checkland, P.B., 1981), *Systems Thinking, Systems Practice*, John Wiley.
- Clarke, M.T., McConachie, H.R., Price, K. and Wood, P (2001) Views of young people using augmentative and alternative communication systems, *International Journal of Language and Communication Disorders* **36** 107-115
- Collins, S. and Murphy, J. (1994) The development of news-tellings in conversations between AAC users and 'natural' speakers *Communication Matters* **8**, 20-24.
- Collins, S. (1996) Referring Expressions in Conversations Between Aided and Natural Speakers. In: Tetzchner, S. and Jehsen, M.H., (Eds.) *Augmentative and Alternative Communication: European Perspectives*, London: Whurr
- Collins, S., Markova, I. and Murphy, J. (1997) Bringing Conversations to a Close: The Management of Closings in Interactions Between AAC Users and 'Natural' Speakers. *Clinical Linguistics and Phonetics* **6** 467 - 493
- Cook, A. M. and Hussey, S. M. (1995) *Assistive Technologies: Principles and Practice* Missouri: Mosby Year Book, Inc.
- Guyard, H., Masson, V. and Quiniou, R 1990 Computer-based aphasia treatment meets artificial intelligence, *Aphasiology* **4** 6
- Harris, D. (1982) Communicative Interaction Processes Involving Nonvocal Physically Handicapped Children. *Topics in Language Disorders* **2**, 21-37.
- Howard, D. and Hatfield, F.H. (1987) *Aphasia Therapy: historical and Contemporary Issues* Hove: Lawrence Erlbaum Assoc. Ltd.
- Huer, M. and Lloyd, L. L. 1990, AAC users perspectives' on augmentative and alternative communication. *AAC Augmentative and Alternative Communication* **6**, 242-249

Hux, (1995) Augmentative and Alternative Communication for Persons with Aphasia
In: Chapey, R.(Ed.) *Language Intervention Strategies in Adult Aphasia* New York:
Williams & Wilkins

Jolleff, N., McConachie, H., Winyard, S., Jones, S., Wisbeach, A. and Clayton, C.
(1992) Communication Aids for Children: Procedures and Problems. *Developmental
Medicine and Child Neurology* **34**, 719-730.

Kraat, A (1990) Augmentative and alternative communication: does it have a future in
aphasia rehabilitation *Aphasiology* **4** 321 – 338

Light, J., Collier, B. and Parnes, P. (1985c) Communicative interaction between
young nonspeaking physically disabled children and their primary care givers: Part II
- communicative function. *AAC Augmentative and Alternative Communication* **2**, 98-
107.

Light, L. 1989, Toward a definition of communicative competence for individuals
using augmentative & alternative communication systems. *AAC Augmentative and
Alternative Communication*, **5**, 137-144

Likert, R. (1956) Productivity supervision and morale in an office situation Michigan

Miller, H. (1995) The Presentation of Self in Electronic Life: Goffman on the Internet
www.ntu.ac.uk/soc/psych/miller/goffman.htm

Mirander, P., Eicher, D. and Beukelman, D.R. 1989, Synthetic and natural speech
preferences of male and female listeners in four age groups. *Journal of Speech and
Hearing Research*, **32**, 175-183.

McConachie, H., Clarke, M.T., Wood, P., Price, K. and Grove, N. (1999) Evaluation
of Speech and Language Therapy for Children using Communication Aids: Final
report to the NHS Executive R&D Programme for People with Physical and Complex
Needs.

Murphy, J., Markova, I., Collins, S. and Moodie, E. (1996) AAC Systems: Obstacles to
Effective Use *European Journal of Disorders of Communication* **31** 31-44

Murphy, J., 1998, Helping People with Severe Communication Difficulties to express
their Views: A low-tech tool, *Communication Matters*, **12** 9

Pennington, L. and McConachie, H. (1997) Mother-child interaction revisited: and in-
depth study of the communication with non-speaking physically disabled children and
their mothers. *The European Journal of Communication Disorders* **34** 1-42.

Plumb, C. and Spyridakis, J.H. (1992) Survey research in technical communication:
Designing and administering questionnaires. *Technical Communications Fourth
Quarter* p.625 - 638

Sherwood, K. D (1994) *A Beginner's Guide To Writing Effective Email*
www.pembrokeshire.co.uk/email).

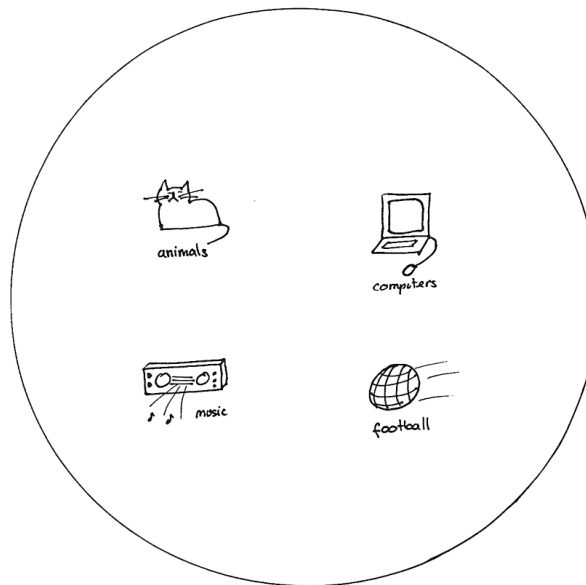
Topics in Language Disorders 1993, 13, **2**

Udwin, O. and Yule, W. (1991) Augmentative communication systems taught to cerebral-palsied children -- a longitudinal study: II Pragmatic features of sign and symbol use *British Journal of Disorders of Communication* **26** 137 – 148

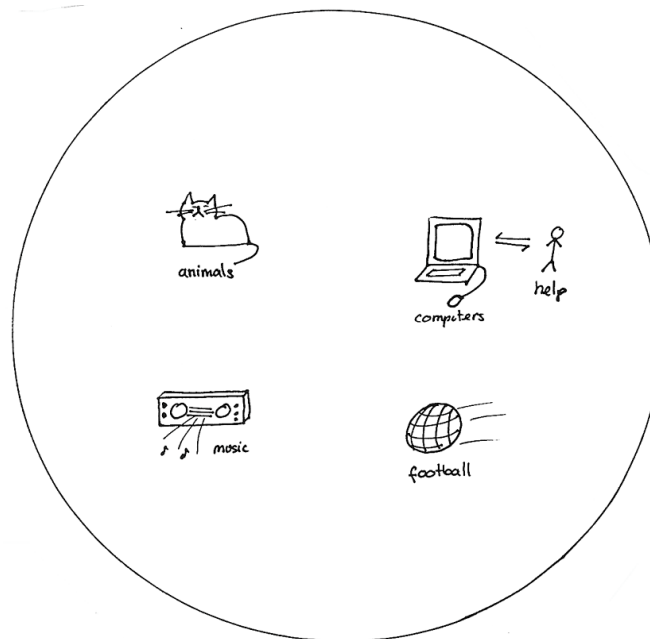
Veselinova, L. and Dry, H. (1995). 'Queries on the LINGUIST List: Acquisition of a Subregister' Paper presented at the 1995 GURT Conference, Georgetown University
In McElhearn, K (1996) *Writing Conversation: An Analysis of Speech Events in E-mail Mailing Lists* <http://www.mcelhearn.com/cmc.html>
Von Tetzchner, S. and Martinsen, H. (2000) *Introduction to augmentative and alternative communication - second edition* London: Whurr,
WWAACIS project (1996) www.wwaacis.org.uk

Appendix 1 Example of a Rich Picture drawn in interview

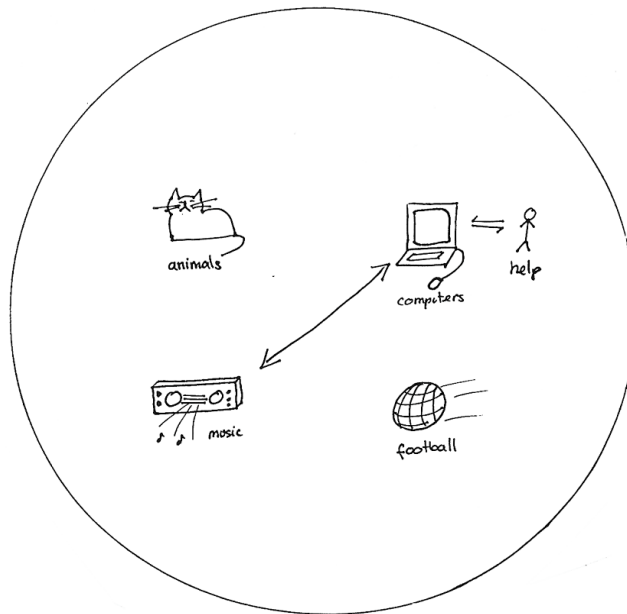
(a) Issues of interest are drawn inside the circle



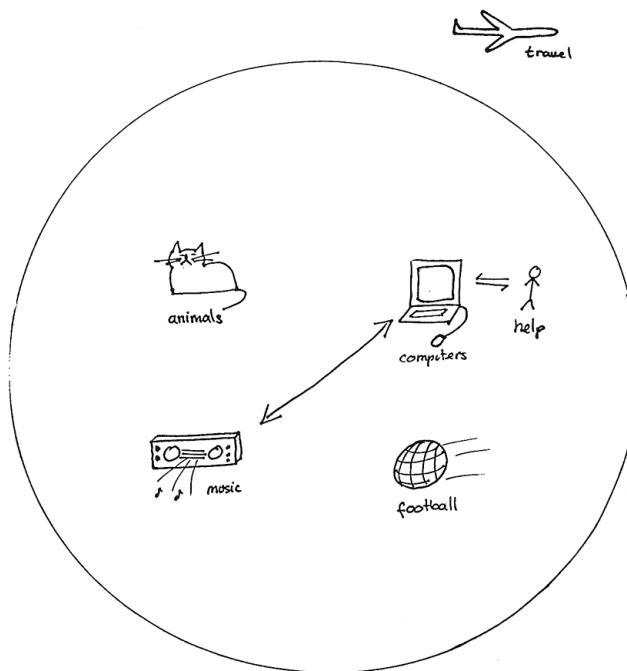
(b) Assistance required for activities is documented



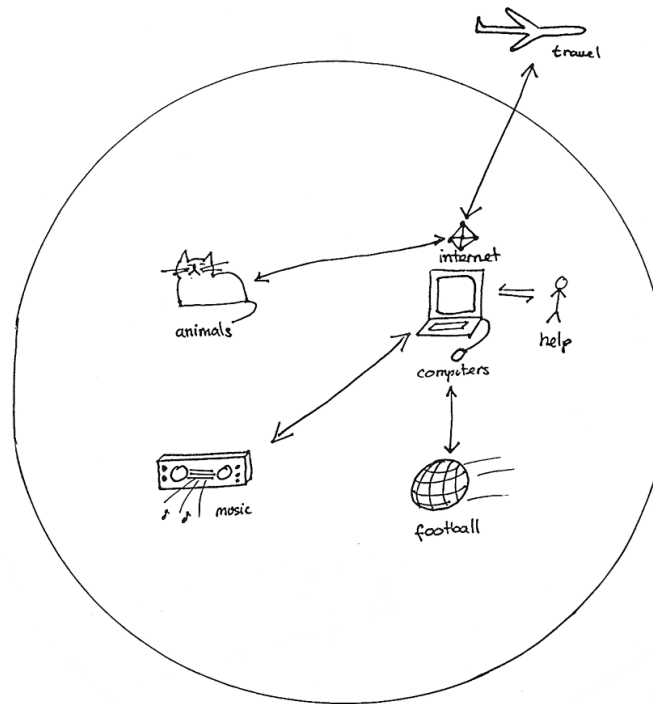
(c) use of computer technology in the pursuit of interests can be documented



(d) Activities that are not currently achievable are drawn outside the circle

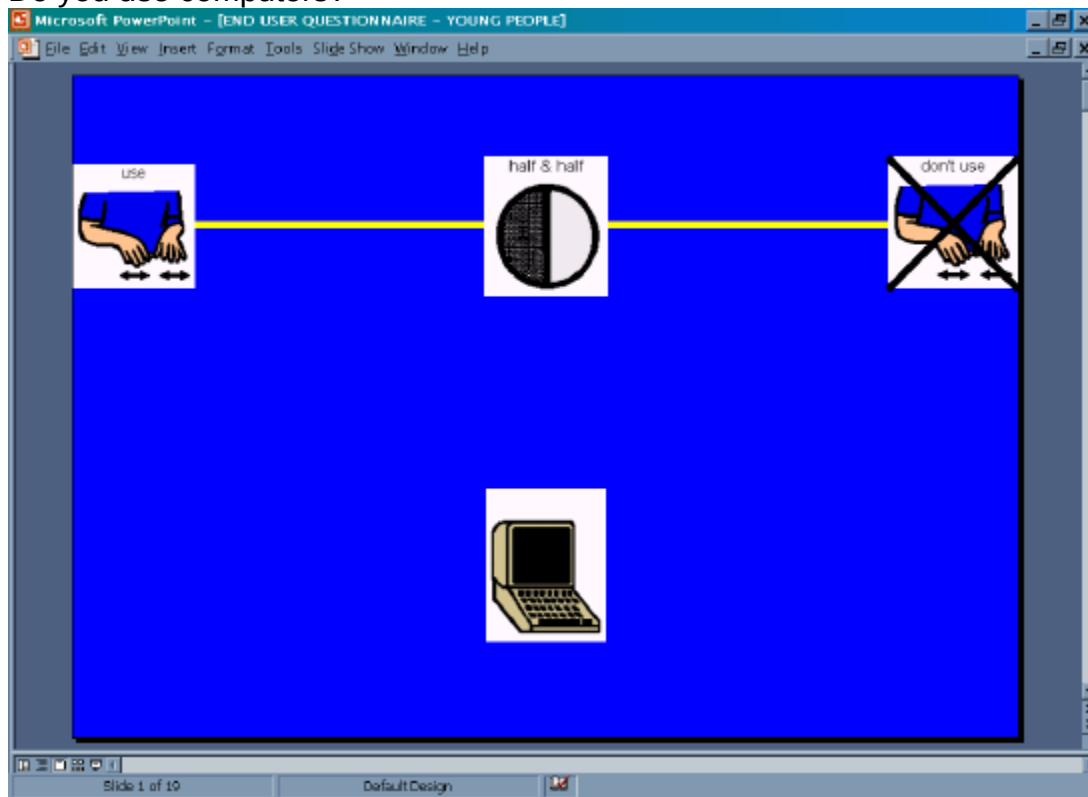


(e) Potential links between the use of Internet services and activates within and outside the circle are recorded

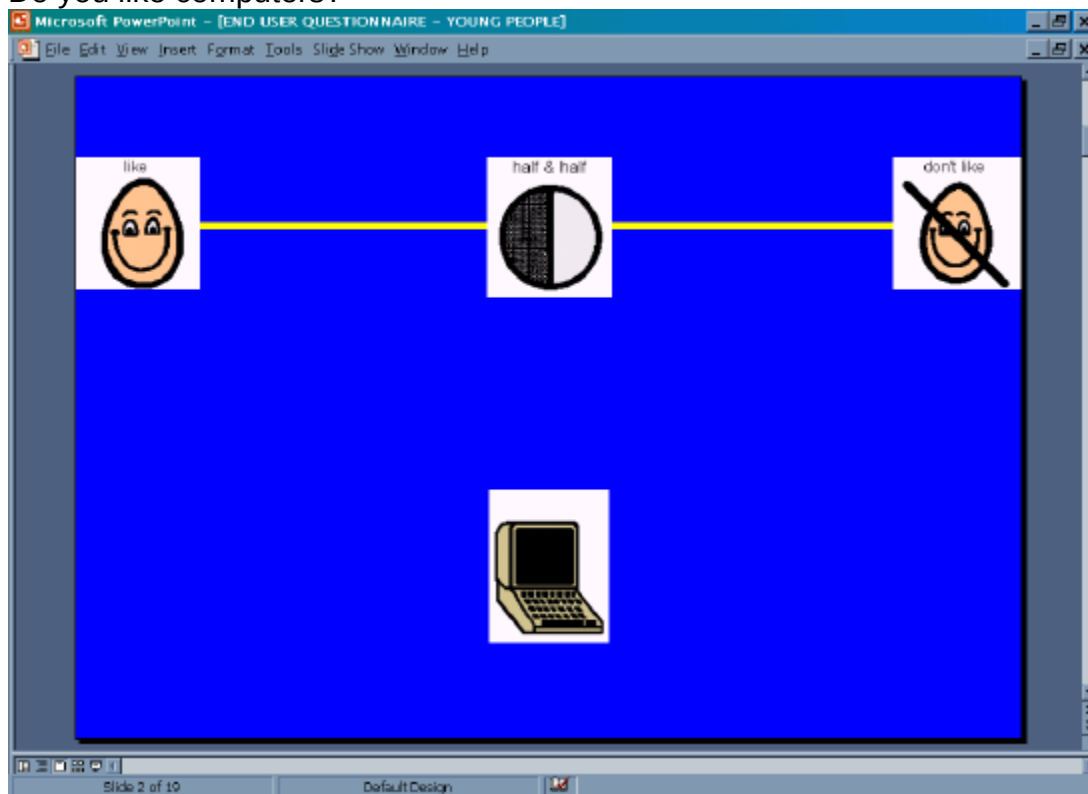


Appendix 2 Examples of PowerPoint representations of interview dimensions

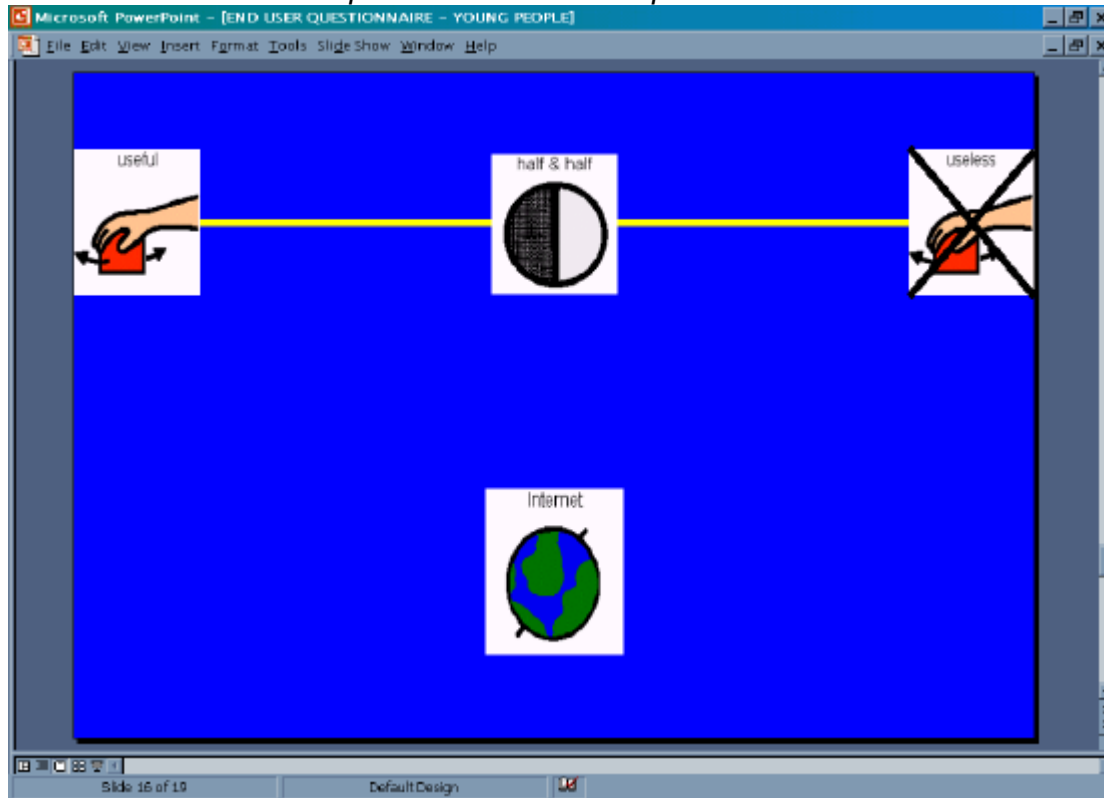
Do you use computers?



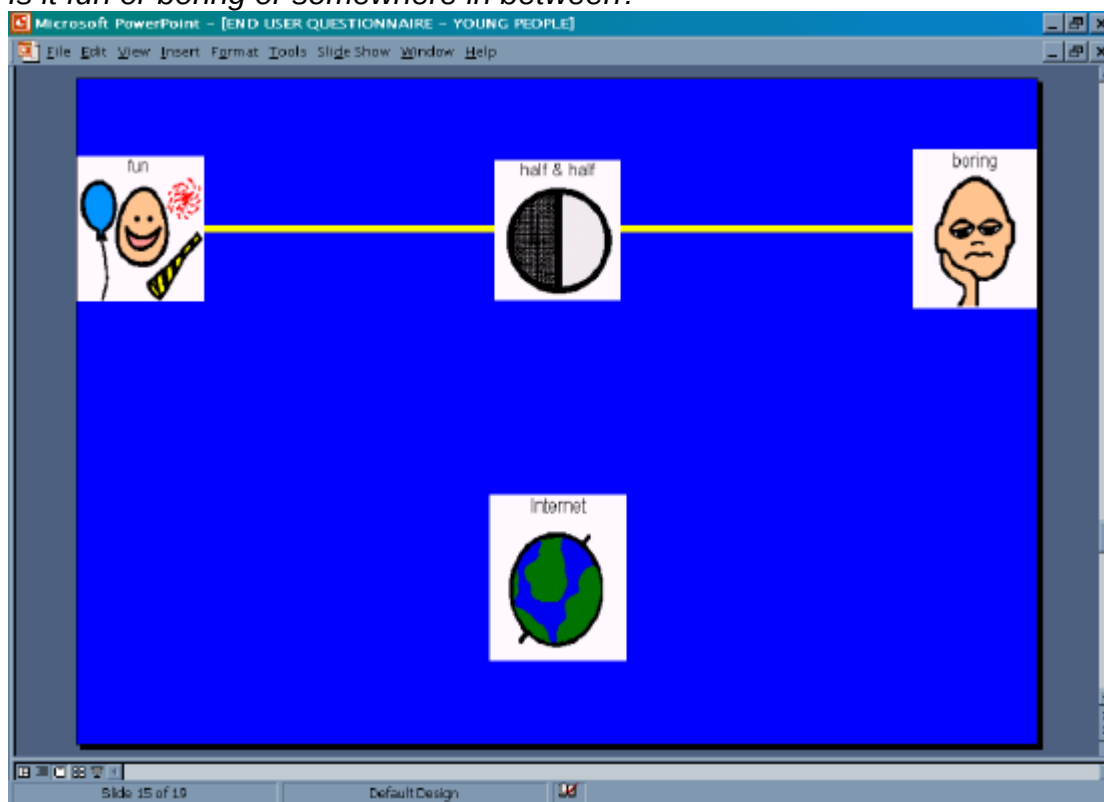
Do you like computers?



Is the Internet useful/helpful or useless/no help or somewhere in between?



Is it fun or boring or somewhere in between?



Appendix 3: Interview for Service Providers

Part I: Professional information

Job title

Specialist field of work.....

Place of work when supporting people using
Augmentative & Alternative Communication (AAC)
(e.g. school, hospital)

Web address, if your organisation also has a web site

.....

Key responsibilities with AAC / Assistive Technology (AT)

.....

.....

Part II: You and your work

1. Which group(s) of people using AAC do you have regular and /or frequent contact with?

.....

.....

2. What service(s) do you provide for them?

.....

3. What proportion of the total number of people you support use AAC?

Tick as appropriate

<25%

<25% –50%

<50% - 75%

<75% - 100%

Please describe the type(s) of AAC/ AT equipment that you support:

.....

Part III: Your clients

4. What symbol systems/sets do your clients use?

Roughly, what proportion (percentage) of your clients use each of the systems you have mentioned? E.g. Bliss 30% PCS 60%, pictures & photos 20%, and so on.

.....

5. Are the symbol systems/sets your clients use typical of the symbol systems/sets used in your country?

Yes ?

No ?

Please describe the type(s) of AAC /AT that your clients use (please include high and low tech devices/tools):

.....

.....

6. What level of literacy skill do your clients have? Identify the proportion/percentage in each of the categories below:

- Platform for literacy (using symbols and pictures only, preliterate skills needed before encoding/decoding can begin)

.....

- Emergent literacy (a basic sight vocabulary of a few hundred words without symbol embellishment, and some basic spelling skills)

.....

- Fluent literacy

.....

Comments:

.....

7. To what degree do your clients combine symbols/pictures into phrases in their expressive communication? Identify the proportion/percentage in the categories below:

- Typically using single symbols
- Typically combining 2 symbols
- Typically combining 3 symbols
- Typically combining 4 symbols
- Typically combining > 4 symbols

8. Typically, to what degree do your clients include aspects of grammar (plurals, tense markers, for example) in their expressive communication? Identify the proportion/percentage in each of the categories below:

- Typically not using grammatical markers
- Typically using AAC systems/devices to mark aspects of grammar
- Typically using other non-verbal means (e.g. gesture) to mark aspects of grammar

Part IV: Barriers to AAC use

9. What are the main problems that people using AAC experience when using low-tech communication devices, e.g. communication charts and books?

.....

.....

.....

.....

10. What are the main problems that people using AAC have when using high-tech AAC devices?

(high-tech = any device which uses advanced electronics to support its operation, i.e. microprocessor, computer, etc.)

Part V: You and the Internet

11. What level of experience do you have with the World Wide Web?

[None.....substantial]

1 2 3 4 5

Please explain your answer

.....

.....

Please list any sites that you are aware of that deal with AAC issues.

.....

.....

12. What level of experience do you have with email?

[None.....substantial]

1 2 3 4 5

Please explain your answer

.....

.....

13. What level of experience do you have with echat or electronic chatrooms?

[None.....substantial]

1 2 3 4 5

Please explain your answer

.....

14. What level of experience do you have with internet discussion groups?

[None.....substantial]

1 2 3 4 5

Please explain your answer

Part VI: Your clients and the Internet

15. Are any of your clients (AAC users/people with aphasia)
using internet-based services, e.g. WWW, Email, Echat,
Discussion groups?

Yes ?

No ?

If so, how many?

What percentage is this of your total number of clients?.....

What types of services are being used?

What are they using these services for?

What problems, if any, do they experience in using these internet-based services?

Are they using any specialist software?

Yes ?

No ?

If so, what packages are being used?

.....

Are they also using PC's adapted in any way (e.g. switch, joypad)? Yes..... ?
No ?

If so, what adaptations are being used?

.....

16. In your opinion, how important is it for AAC users to write using grammatical sentences when using email, echat and discussion groups?

[not at all important.....extremely important]

1 2 3 4 5

Do you believe that simplified forms of expression are sufficient,
e.g., telegraphic writing? Yes ?
No ?

Comments:

.....

.....

17. In your opinion, how important is it for a symbol user that a conversation partner over the Internet is not aware that he/she has a communication impairment?

[not at all important.....extremely important]

1 2 3 4 5

Comments:

.....

.....

Part VII: Internet Use in the Future

18. For those clients not using Internet-based services, what do you think are the barriers to their active use of email, echat, discussion groups and the Web?

.....

.....

.....

.....

19. What do you think they might like to use these services for in the future?

.....

.....

.....

20. What sorts of Internet-based services should be developed in the future to support those with communication difficulties?

.....

.....

.....

Part VIII: Improving Access to the Internet

21. Are you aware of any guidance/guidelines to create web pages so that they will be usable by people with communication problems? Yes ?
No ?

If Yes, please explain what topics they cover and where they can be obtained.

.....

.....

.....

22. What kinds of guidelines do you think are needed in order to create web pages that will be more usable by people with communication difficulties?

.....

.....

.....

.....

23. In what other ways could access to the Internet be improved for people with communication needs?

.....

.....

.....

.....

I am interested in getting involved in evaluation of WWAAC products

Name (please print):

Contact address:

.....

.....

.....

Tel:

Email:

Appendix 4: Questionnaire for Manufacturers

Name of Manufacturer

Developer	?	Software	?
Distributor	?	Hardware	?

Country:

Name of person:

Job title and responsibilities:

.....

1. What sort of products do you develop or distribute?

.....

2. What platforms are these designed to operate on? (Windows 95, 98, 2000, NT, Mac)?

.....

3. Who are your main target groups?

.....

4. What are these products mainly used for?

.....

.....

5. Do your products involve the use of the WWW or email? Yes ?
No ?

If yes, in what way?

.....

.....

6. How do you see your products developing in the future?

.....
.....

7. Are you aware of any problems that your clients with communication impairments have when using your products? Yes ? No.....?

If so, what are they?

.....
.....
.....

8. Do you promote your services on the WWW? Yes ? No ?

If so, what is the web address?

.....

9. Are you aware of any guidance/guidelines to create web pages so that they will be more usable by people with communication problems? Yes ? No ?

If so, please describe:

.....
.....

10. What guidelines/guidance would you like to see in order to create WWW pages so that they will be more usable by people with communication problems?

.....
.....

11. Are you aware of any standards used in the development of AAC? Yes ?
No ?

If yes, which ones?

.....
.....

12. What development in standards do you feel is needed to support advancements in symbol-based communication aids?

.....
.....

If appropriate, provide a demonstration of relevant symbol-based software.

13. Do you see a future for web access with AAC devices Yes ?
using symbols? No ?

Comments:

.....
.....

14. Do you see a future for email with AAC devices using symbols? Yes ?
No ?

Comments:

.....
.....

15. Do you see a future for echat with AAC devices using symbols? Yes? No ?

Comments:

.....

.....

16. Do you see a future for discussion groups with AAC devices using symbols? Yes ? No ?

Comments:

.....

.....

17. What role do you think mobile phones or personal digital assistants (PDAs) might play in this process?

.....

.....

18. Please rank from 1 to 4, with 1 for most likely and 4 for least likely, the future of the following developments for AAC devices using symbols:

web access	
email	
echat	
discussion groups	

Further Comments:

.....

.....

.....

.....

Appendix 5: Letter concerning end user screening criteria



c/o Ace Centre
92 windmill Road
Headington, Oxford, OX3 7DR
United Kingdom
Tel: +44 (0)1865 759800
Fax: +44 (0)1865 759810
Clarke@ace-centre.org.uk

Dear Colleague

**Re: WWAAC project
(World Wide Augmentative & Alternative Communication)**

The WWAAC project aims to make the Internet and use of email much more accessible for people who use Augmentative & Alternative Communication, and other assistive technologies. To do this, the project aims to develop new computer technology that will allow people with communication disabilities to do things like:

1. Easily access and retrieve information from the World Wide Web
2. Use email. This means sending an email written in your own symbol system and language, knowing that the person who receives it will have your message translated into their own symbol system, (if they use one) and language. That way, someone using Picture Communication Symbols in England can communicate with someone using Bliss symbols in Sweden

An information leaflet is enclosed, which we hope will give more insight into the project background and aims. Alternatively, you may wish to visit our Website: www.wwaac.org

In order to make sure this new technology really meets the needs of people with communication disabilities, we want to involve people using augmentative & alternative communication, and other assistive technologies, in the design process right from the start.

We are looking for *volunteers* who use AAC and other technologies, to help us in the User Evaluation aspects of this project. As someone who works with people using AAC and other assistive technologies, you may know AAC users who might be interested in getting involved with this project.

Ideally we would like to work with AAC users who:

- ◆ Have *receptive* language abilities sufficient to understand discussion concerning strengths and weaknesses of technology
- ◆ *Cognitive* abilities such that they can think about, and understand, abstract concepts such as *email*, and *discussion fora*
- ◆ Adequate *visual* acuity and visual processing abilities to work with pictures, symbols and/or simple text on a computer screen
- ◆ People who are *interested* in the internet and *motivated* to explore ways of using Internet Services
- ◆ There are no criteria for expressive communication skills

In addition to the information leaflet, we have enclosed an *information pack* for people using AAC and their families, friends, carers and so on. This pack includes a *letter* of introduction, an *information* leaflet and *consent* forms. You may find these useful when talking to your client's about the project.

We hope that you will get involved with this project. We believe that the WWAAC project will open up Internet Services to those who have, as yet, been excluded realising the potential of the Internet.

Best wishes

Yours sincerely

Mike Clarke
on behalf of the WWAAC partners