

Concerning information accessibility, this group is still not able to fully benefit from the use of computers and the Internet. The Japanese Ministry of Public management, home affairs, Posts and Telecommunications (2004) reported the diffusion of the Internet access using telecommunication devices as shown in Table 1. The number of people who access the Internet is the lowest among people with intellectual disabilities. The number is also relatively low for people with physical disabilities. This survey shows the figures for people with visual or auditory disabilities higher than those for people without disabilities. This is probably because the sampling for disabilities was carried out from a well-educated population. In reality, the numbers for people with sensory disabilities would probably be lower than for non-disabled population. There are various information barriers for each disability. Web accessibility and captioning system for visual contents are helpful for people with sensory disabilities. However, even when information is received, it may not be understood by people with intellectual disabilities. Also, some people cannot convey their information to others because of their speech disabilities and /or intellectual disabilities. In this case, people who would like to communicate with them, non-disabled people in many cases, have an accessibility problem. There has been little research on the accessibility issues of information output by people with severe disabilities.

Table 1 Ratios of people who access the Internet within a population with disabilities in Japan.

Disability	Access Device	Ratio
None	PC	48.3%
	Mobile Phone	35.2%
	Game +TV	3.1%
	PC +Mobile Phone +TV	60.6%
Visual	PC	69.7%
	Mobile Phone	44.4%
Auditory	PC	81.1%
	Mobile Phone	65.4%
Physical	PC	43.6%
	Mobile Phone	18.0%
Intellectual	PC	19.6%
	Mobile Phone	8.6%

2 The Mobile Phone and the Web as a Tool for Communication

2.1 Problems with current technical assistance

At present, there are a number of different types of technology available for communication for people with disabilities (e.g., Beukelman & Mirenda, 1998; RESNA, 2000). Assistive technology supports both the information input and output of people with disabilities. For example, for receiving information, a hearing aid can help people who are deaf or hard of hearing, and a screen-reader can help people who are blind or have low vision. On the other hand, for providing information, a communication aid can help non-speaking people to express their ideas. There are also technical contributions of web accessibility and universal design, which make information easy to access for people with disabilities (Figure 1).

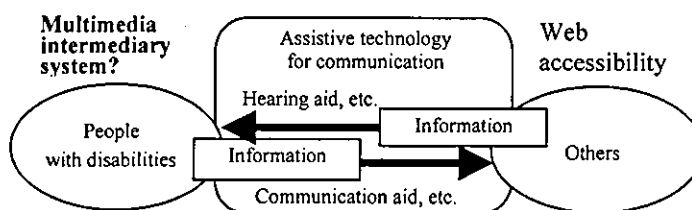


Figure 1 Technical assistants for people with communication difficulties.

However, there are still many people who have communication difficulties using existing technologies. In particular, people who have intellectual, multiple, or severe physical disabilities can still have problems with successful conversation. One reason for this is the difficulty of message creation. For example, it is not easy for people with severe intellectual disabilities to express their ideas and needs. Message creation is also a problem for people with mobility impairments using a single switch interface to operate their communication devices, as it can be quite time consuming. Non-verbal information conveyed in a variety of ways, such as facial expression, gesture, or vocal expression (e.g., intensity, accent, and speed), is another area in which current communication aids fall short, although there has been some related research in this realm (Murray & Arnott, 1995; Nakamura, Inada, Alm & Iwabuchi, 1998). Additionally, some types of information are also difficult by nature to convey using only words, such as communication about optimum body position, type of movement, or correct timing in care giving settings (Iwabuchi, Nakamura, Fujiwara, Alm & Burgstahler, 2003). In the care giving situation, recipients of care and care givers often adjust their conversation flow carefully in order to reach a mutual understanding, but the use of existing communication aids puts a limitation on the flexibility of this conversation.

2.2 Possibility of using information technology

Nakamura, Arima, Sakamoto & Toyota (1993) pointed out that the introduction of the disability of a person with speech problem to communication partners in advance enables the non-speaking person to have a smoother conversation. We believe that the use of multimedia for communication can convey more precise information about the user's disabilities than existing communication methods and in many cases, could alleviate misunderstandings, increase confidence, and facilitate the conversation between the user and their communication partners. Incentives to communicate and providing conversational topics are also important factors in communication. Millar (2004) highlighted the importance of personal information disclosure for communication and developed a format called the "Personal Communication Passport". In Japan, some parents of autistic children created a similar tool called a "Support Book". Both Personal Communication Passports and Support Books are paper-based communication aids. Paper-based tools are light and compact, cheap, and easy to carry. However, they have some limitations in conveying vivid or sequential information compared with movie and sound.

Current information technology, such as third generation cellular phones, makes it possible to incorporate multimedia into mobile communications, and this new capability may be useful in conveying such support information for people with disabilities. As well as the prototype described here, a number of research systems have been developed which support communication with a multimedia presentation (Gowans, Alm, Astell, Campbell, Dye, & Ellis, 2002; Hine, Beattie, & Arnott, 1998; Hine, & Arnott, 2002; Iwabuchi et al., 2003). Internet access using mobile phones has become extremely widespread in Japan. The Japanese Ministry of Public management, home affairs, Posts and Telecommunications (2004) reported that 20.9% of mobile phone users access the Internet everyday for such purposes as checking travel timetables, booking concert tickets and so on. This developing social infrastructure which the Internet makes possible could provide valuable communication opportunities for people with severe disabilities.

In discussing information accessibility, we tend to focus on one-way accessibility by people with disabilities. However, people who are working around people with severe disabilities also suffer from not being able to access information, from the people with disabilities. This sometimes creates serious misunderstandings. Information technology could thus offer help both to people with and people without disabilities

3 Development of the e-PP (electronic personal profiler) System

We developed a server side program that makes it possible to create or browse personal web pages using a mobile phone. The concept is similar to a Weblog, but specifically designed as a communication tool for people with disabilities. The system is called the "electronic personal profiler (e-PP)", and it operates as shown in Figure 2. An electronic intermediary system such as this, which uses multimedia for exchanging information, may help to alleviate some of the difficulties outlined above. However, multimedia information might violate

privacy, which must be taken into account. For example, a video of how to help with dressing or helping in the bathroom is hardly suitable for use in public. The prototype currently contains individual-dependent information about communication methods, feeding, medicine, physical support, and personal preferences. The categories were chosen following the findings of the survey. The prototype can be accessed using mobile phones and other Web access devices. Mobile phones of course allow a flexible use in terms of time and place. Personal profile pages can be created by typing directly into the e-PP system. A mobile phone with a camera attached enables the user to easily add visual data by submitting pictures to the system as an e-mail attachment.

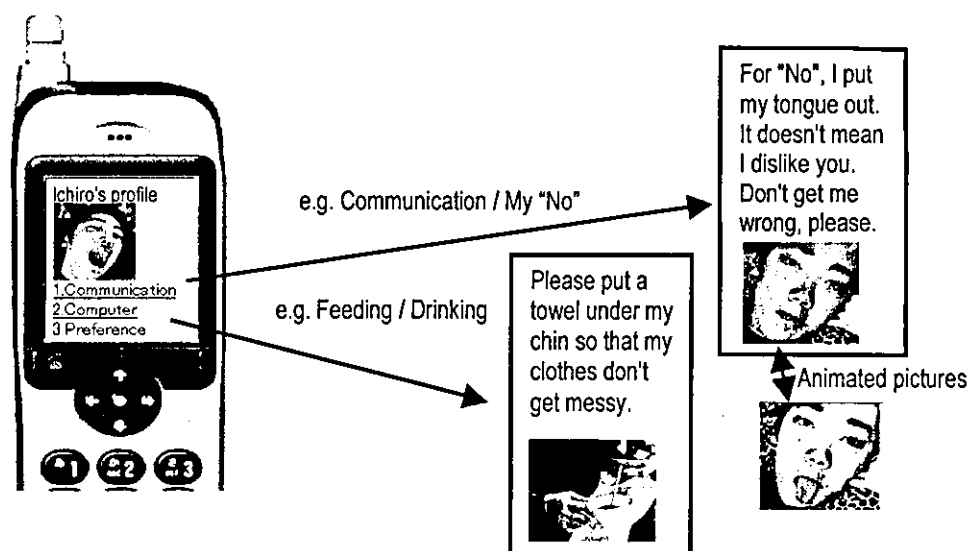


Figure 2 An example of a user's profile on e-PP system.

4 The e-PP System in Care Giving Settings

We collected comments from professional care providers about the potential of the practical use of e-PP after a demonstration of the system. A qualitative study was also conducted at a special school for children with intellectual disabilities.

4.1 Care giving staff at nursing homes and a residential institution

The e-PP system was demonstrated at three nursing homes for elderly people and a residential institution for people with disabilities. The nursing homes provide day care service and visiting home help service as well as a residential service. Table 2 shows the responses from the directors and staff of these facilities..

Table 2 Comments on the use of the e-PP in a practical situation.

Merits	<ul style="list-style-type: none"> ● Animated pictures help to understand sequential procedures in care giving. ● There are a limited number of computers available for the staff, which can access to the clients' profiles. It would be very convenient if mobile phones could be used for this. ● The capability of checking profiles while on the move would be useful for staff who provide visiting home help service. ● A visiting home help service is often carried out by more than one service provider. It would be beneficial to share a common profile of the client among the providers.
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Demerits/ Concerns	<ul style="list-style-type: none"> ● How do we avoid privacy violation if the data can be accessed anytime and anywhere using a mobile phone? ● A system which provides an introduction to the person is not needed for a place like ours where clients stay for months. ● I would be reluctant to use the system unless the data is automatically provided using a “push” technology. I neither e-mail nor access the Web with my mobile phone. I just sometimes read any e-mail received. ● Not sure if the system can be cost-effective.
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Older staff members tended to have more to say on possible problems with such a system. It is possible that their skill and knowledge about mobile phone use influenced their feelings about whether or not they wanted to use the system.

4.2 Trainee students at special school

We asked trainee students at a special school for children with intellectual disabilities to use the e-PP before meeting their students. They had no negative expectation about using the system. As a group they often use mobile phones and are familiar with using a mobile phone for Web access. We are still collecting data and cannot report the quantitative results. We briefly introduce their opinions toward e-PP system as below:

"I was nervous before meeting person with disabilities. The information of student by e-PP system made me comfortable."

"I hesitated using it because use of mobile phone during work hour in school is not good."

"I thought paper based information sheet might be more convenient before using e-PP. However, there was no difference about usability"

5 Conclusions

Physical accessibility of products and Web accessibility are often the main focus of efforts to widen accessibility. Accessibility should be closely evaluated with people with disabilities in their daily living situations where often many other people are involved. In this study, we have widened the definition of accessibility to include accessibility by the carer and other people to the communication of a disabled person. Information technology can play a substantially important role here. We hope the e-PP system will be an example of such an application. Good communication about themselves is important particularly for people with disabilities because lack of such information often leads others to unnecessary misunderstandings and/or anxiety. Although it is important to understand about disabilities in general in order to provide a desirable support for people with disabilities, having a good knowledge about disabilities does not always guarantee a good support for a particular individual. In each case, it is of great importance to understand each person as a person well as his/her disabilities. It would be important to include information which reflects the user's personality on e-PP. The latest high technology with the power of multimedia again could work well in conveying this kind of information.

We have been concerned the small size of the screen and the keyboard of mobile phones. A small screen makes it difficult for the user to read. Small keys make it difficult to control the phone. However, there was no complaint about those features from the student subjects in the experiment. These young students did not show any major difficulty or hesitation in navigating the e-PP system. On the other hand, many staff, in particular people over the age of forty, at the nursing homes and the residential institution we interviewed were reluctant to use the system. They said they had not used the Web and were reluctant to try to do this using a mobile phone. We can guess how this situation might change in a few years' time? We hope that, with efforts such as the one we have described, exchanging information will be more barrier-free in the future, which will insure more accessible communication for all people, including people with severe disabilities.

References

Beukelman, D.R., & Mirenda, P. (1998). *Augmentative and alternative communication: Management of Severe Communication Disorders in Adults and Children*. Baltimore: Paul H. Brookes Publishing.

Gowans, G., Alm, N., Astell, A., Campbell, J., Dye, R., Ellis, M. (2002) CIRCA (Computer Interactive Reminiscence and Conversation Aid). *Proceedings of 18th International Conference of Alzheimer's Disease International*, Barcelona, Spain, October 23-26, 2002.

Hine, N., & Arnott, J. (2002). A multimedia storytelling system for non-speaking people. In S. Vintergaard (Ed.), *Proceedings of the ISAAC 2002 International Conference* (pp.87-88), Toronto: International Society for Augmentative and Alternative Communication.

Hine, N., Beattie, W., & Arnott, J. (1998). Architecture of portable multimedia augmentative and assistive communications system. In S. Blackstone (Ed.), *Proceedings of the ISAAC 1998 International Conference* (pp. 461-462), Toronto: International Society for Augmentative and Alternative Communication.

Iwabuchi, M., Nakamura, K., Fujiwara, Y., Alm, N. & Burgstahler, S. 2003 An electronic name card system on a mobile device for people with disabilities and elderly people. HCI International 2003 In Stephanidis, C. (Ed.) *HCI International 2003 Adjunct Proceedings*. Pp243-244. Heraklion, Greece: Crete University Press.

Japanese Ministry of Public management, home affairs, Posts and Telecommunications (2004) *2004 White Paper "Information and Communications in Japan"*.
<http://www.johotsusintokei.soumu.go.jp/whitepaper/eng/WP2004/2004-index.html>

Murray, I.R. & Arnott, J.L. (1995). Implementation and testing of a system for producing emotion-by-rule in synthetic speech. *Speech Communication*, 16, 369-390.

Nakamura, K., Inada, T., Alm, N., & Iwabuchi, M. (1998). Exploiting new technical developments to convey nonverbal information with communication aids. In S. Hata (Ed.), *Proceedings of IEEE International Workshop on Robot and Human Communication '98: Vol.1* (pp. 268-273). Piscataway, NJ: The Institute of Electrical and Electronics Engineers.

Nakamura, K., Arima, M., Sakamoto, A., & Toyota, R. (1993). Telephoning with a voice output device: How do receivers feel and act when they are called by someone using a voice output device? *Augmentative and Alternative Communication*, 9, 1-15.

RESNA. (2000). *Fundamentals in Assistive Technology*. Arlington: RESNA.