Networked Reminiscence Therapy for Individuals with Dementia by using Photo and Video Sharing

Noriaki Kuwahara
ATR Intelligent Robotics and Communication Laboratories
Kyoto, Japan
+81-774-95-1447
kuwahara@atr.jp

Shinji Abe
ATR Intelligent Robotics and Communication Laboratories
Kyoto, Japan
+81-774-95-1463
sabe@atr.jp

Kiyoshi Yasuda
Chiba Rosai Hospital
Chiba, Japan
+81-774-95-1447
fwkk5911@mb.infoweb.ne.jp

Kazuhiro Kuwabara
Ritsumeikan University
Shiga, Japan
+81-77-561-5980
kuwabara@is.ritsumei.ac.jp

ABSTRACT
Reminiscence therapy, which is effective for increasing the self-esteem of and for reducing behavioral disturbances in individuals with dementia, is usually conducted in a group led by experienced staff. However, due to the shortage of care attendants, only a limited number of patients at home can receive the benefits of this therapy. To provide this therapy for patients anytime or anywhere, we have developed a networked reminiscence therapy system that combines IP videophones with a photo- and video-sharing mechanism based on Web technology. First, we prepared the experimental setup in a hospital and examined whether dementia patients could communicate with therapists by videophone. Then we conducted a field trial of networked reminiscence therapy with a more realistic situation where remote volunteers communicated with dementia sufferers in the care home by IP videophones connected by broadband network. In this paper, we describe our developed system. Then, we present experimental results showing that dementia sufferers could communicate with therapists by videophone and that networked reminiscence sessions were generally as successful for individuals with dementia as face-to-face reminiscence sessions.

Categories and Subject Descriptors
H.4.3 [**Communications Applications**]: *Computer conferencing, teleconferencing, and videoconferencing*

General Terms
Design, Experimentation

ASSETS'06, October 22–25, 2006, Portland, Oregon, USA.

Keywords
Reminiscence Therapy, Dementia, Internet, IP videophone, Web Browser, Photo Sharing

1. INTRODUCTION
Providing a high standard of care for people with dementia is becoming an increasingly important issue as societies continue to age. At the same time, supporting the daily lives of elderly people with dementia and various related behavioral disturbances such as wandering, agitation, illusion, and incontinence, puts a great burden on caregivers, who are often family members [1]. Since home caregivers bear a heavy burden, they need some regular respite time [2].

To help reduce this burden on caregivers, intervention for behavioral disturbances is required [3, 4]. While pharmacotherapy has proven useful, its effects are limited to certain types, symptoms, and stages of dementia. Undesirable side effects also limit the frequent usage of medication [5]. To augment pharmacotherapy, in addition to traditional therapy [4, 6], computer-based intervention is also being investigated [7, 8]. Although the effectiveness of these alternative approaches has not generally been established, reminiscence therapy is reported to bring peace of mind to patients and help reduce behavioral disturbances [4, 9]. In a reminiscence therapy session, a therapist prepares tools, toys, photos, and paintings relating to an earlier time when the individual with dementia was younger [4] and applies them to effectively stimulate memories. However, a reminiscence therapy session is usually conducted in a group led by experienced staff at institutions. Despite its effectiveness, reminiscence therapy is difficult to perform at home due to a shortage of experienced staff.

To provide patients at home with an equal opportunity to receive this therapy's benefits, we have developed a system for networked reminiscence therapy that utilizes IP videophones and a Web-based photo- and video-sharing system. Our intention is to produce similar effects to those experienced in a face-to-face reminiscence session by photo and video sharing. Before

implementing the system, we conducted a feasibility study on communication with dementia sufferers by IP videophone in a hospital. We have since implemented the system and conducted a field trial in collaboration with a telecom company, a senior care home company, and a nonprofit organization (NPO) that dispatches volunteers for active listening with elderly people, including dementia patients.

In this paper, we present the problems that must be overcome for implementing a networked reminiscence therapy system, outline our design approach for the system, and provide an overview of the system architecture. We then present the results of our feasibility study in a hospital that involved talking by IP videophone with individuals suffering from dementia and explain field trials in collaboration with the organizations mentioned earlier. Next we show the results of our field trial based on questionnaire surveys and interviews with the participants of this trial. Finally, we discuss the benefits brought by the networked reminiscence therapy and conclude the paper.

2. DESIGN APPROACH

Our design approach is comprised of the items listed below:

(1) IP Videophone for Patient's Terminal

(2) Incorporation of Photo and Video Sharing

(3) Reminiscence Videos

(4) Remote Terminal Operation Assistance using Web Technology

(5) Multimodal Interface for Communication

Bi-directional video communication is essential for implementing a networked reminiscence therapy system (1). Furthermore, to ensure that the patient remains engaged in the networked reminiscence session, our approach incorporates videophone and reminiscence content sharing (2), (3).

However, the patient and family caregiver may need assistance to operate content sharing because they are usually elderly themselves or they might not be familiar with the concept of content sharing over a network. They will most likely encounter difficulties and remote assistance is necessary from the therapist's terminal to operate the contents. Therefore, we developed a protocol between Web browsers so they can share contents with each other and operate them from a remote Web browser (4).

In face-to-face sessions, the patient often touches an object while talking about a topic related to it because touching is very intuitive and enables the talking partner to recognize patient interest. Although remote therapy sessions are mainly performed by the therapist operating the patient's terminal, we provide patients with a way to inform therapists of their interest by simply touching the object or person in the photo (5).

In this section, we explain the design features of our networked reminiscence system based on our design approach. These features are listed below, and we describe the details of each in the following sections.

2.1 IP Videophone for Patient's Terminal

By 2005 in Japan the household broadband penetration rate was approaching 40%, and bi-directional video communication over the Internet is also gradually increasing in popularity. Also, there are commercial IP videophone products that are as easy to use as home electric appliances that provide simple interfaces with a touch panel screen. Therefore, such devices are suitable as patient terminals to offer networked reminiscence therapy at home. Note that family caregivers who support their patients during therapy sessions with a remote therapist are often elderly themselves and have difficulty handling conventional personal computers.

2.2 Incorporating Photo and Video Sharing

Adding bi-directional video communication, we incorporate photo- and video-sharing functions in our networked reminiscence therapy system. In face-to-face reminiscence sessions, a therapist prepares tools, toys, photos, and paintings relating to an earlier time and uses them to effectively stimulate patients' memories that calm them. Shared attention between patient and therapist is important. In contrast, in a networked reminiscence therapy session, a therapist conducts a conversation with a patient at home or at a care facility by videophone. In such networked reminiscence therapy, however, it is difficult to exploit physical objects. To solve this difficulty, in a networked reminiscence therapy system, photos (images) of old times or personal photos and videos produced by using such photos are stored in a network server.

2.3 Reminiscence Videos

We use reminiscence videos as video contents because they have been experimentally proven to bring dementia patients peace of mind [10]. A reminiscence video is a kind of slideshow video produced by using the personal photos of patients. It comes with audio and visual effects. The latter include panning and zooming to the region depicting a person the patient is interested in, and the former include background music (BGM) and suitable narration that makes the video more engaging. These effects are applied to each photo based on the meta-data annotated by the video author beforehand [11, 12]. Reminiscence videos are generated in SMIL format, which is very compact and suitable for delivering videos by Internet.

2.4 Remote Terminal Operation Assistance using Web Technology

Photo- and video-sharing functions are implemented with Web technology to avoid a system that depends on specific hardware and operating systems, because IP videophones that feature a Web browser function are now quite popular. Of course, some photo-sharing sites already exist on the Internet, managed by well-known providers (for example, Google™ and YAHOO!®). However, these sites are designed for unimpaired people who can use Web browsers without the support of a remote talking partner, not for interactive photo sharing between remote users. To implement remote support for using a Web browser and interactive photo- and video-sharing, we developed a messaging mechanism between remote Web browsers over HTTPS [13]. Using this mechanism enables a therapist to support a patient in sharing photos and videos by sending messages about operating the remote Web browser on the patient's terminal.

2.5 Multimodal Interface for Communication

To engage the patient more deeply in a networked reminiscence session, we prepare intuitive interfaces for the patient and remote therapist to operate photos and videos. First, we provide them with an interface that informs each other of a specific object or

person that they are interested in. It only requires touching the photo on the terminal display. The touched position on the photo is recorded, and the corresponding position in the photo on the remote terminal is highlighted. Second, we allow the therapist to remotely operate the photo on the patient's terminal, for example, panning and zooming objects or persons in question. Our experiments showed that panning and zooming specific objects or persons in photos effectively made patients feel more involved when watching the reminiscence video [14]. We believe that these effects are also important in networked reminiscence sessions. These remote content operations are also based on a messaging mechanism between remote Web browsers.

3. SYSTEM OVERVIEW

In this section, we first provide an overview of the system architecture from hardware and software configuration perspectives. Then, we show the features of both the patient's and the therapist's terminals with examples of GUIs for networked reminiscence therapy.

3.1 Architecture

Figure 1 illustrates the hardware configuration of our system. The therapist and patient communicate through an IP videophone by using its proprietary or standard protocol. The Directory Server resolves the network address of the patient's terminal when the therapist starts a connection. Shared photos and videos are stored in the Community Platform, which the therapist and patient can obtain by using HTTPS protocols. Also, Web browsers on both terminals exchange messages to operate the content to be shared.

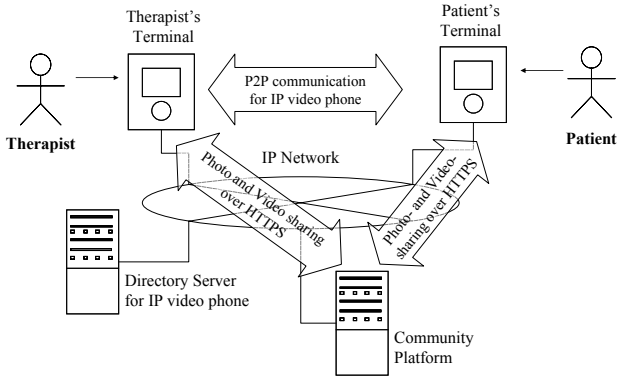

Figure 1. Hardware configuration of system

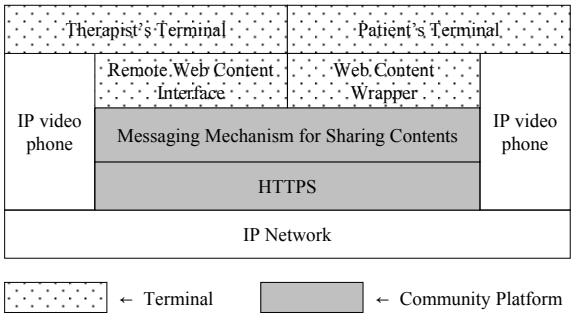

Figure 2. Software components of system

Figure 2 is a "layer cake" of the system's software components. We have already implemented a messaging mechanism for sharing contents such as photos and videos on Web browsers [13]. To operate a photo or video on the patient's terminal, the therapist's terminal invokes remote content APIs called the Remote Web Content Interface. After the patient's terminal displays the content, the Web Content Wrapper sends a request to obtain messages from the therapist's terminal to the Community Platform by using asynchronous HTTP Requests. When a message is sent from the therapist's terminal, the Web Content Wrapper invokes a local method for operating the content displayed on the local Web browser.

3.2 Patient's Terminal

The patient's terminal has the following features:

- It automatically receives calls from the therapist's terminal. Of course, patients can refuse them.
- It can display the content stored in the Community Platform selected by the remote therapist.
- It can perform panning and zooming of a specific object or person in the photo displayed on the patient's terminal by therapist remote operation.
- It can play, pause, and stop the reminiscence video on the patient's terminal by therapist remote operation.
- The patient can inform the remote therapist of a specific object or person in the photo by touching it on the patient's terminal. The corresponding position in the photo displayed on the therapist's terminal can be highlighted.
- Besides automatically responding to a therapist's call, the patient's terminal contains an address book for the therapist's terminal that can be displayed on the touch panel screen. This function is intended to let the patient or family caregiver initiate a therapy session with a one-touch operation.

Figure 3 shows GUI examples of the patient's terminal when the therapist chooses a photo (1) and performs panning and zooming to a specific person in the photo (2).

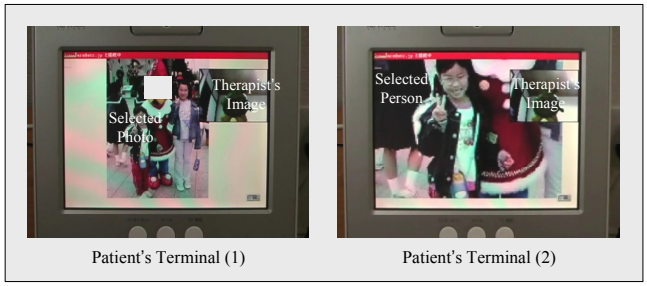

Figure 3. GUI examples of patient's terminal

3.3 Therapist's Terminal

The therapist's terminal has the following features:

- It contains an address book for patients that it displays on the touch panel screen. The therapist can call them with a one-touch operation.

- After connecting to the patient's terminal, the therapist's terminal can display thumbnail images of stored photos in the Community Platform from which the therapist can select with a one-touch operation. The selected photo is then displayed on both terminals.
- The therapist can specify the rectangular region in which to perform panning and zooming to engage the patients much more deeply in networked reminiscence sessions.
- For sharing with the patient, the therapist can select a reminiscence video from thumbnail images corresponding to reminiscence videos with a one-touch operation and play, pause, and stop the displayed video on both terminals from the therapist's terminal.

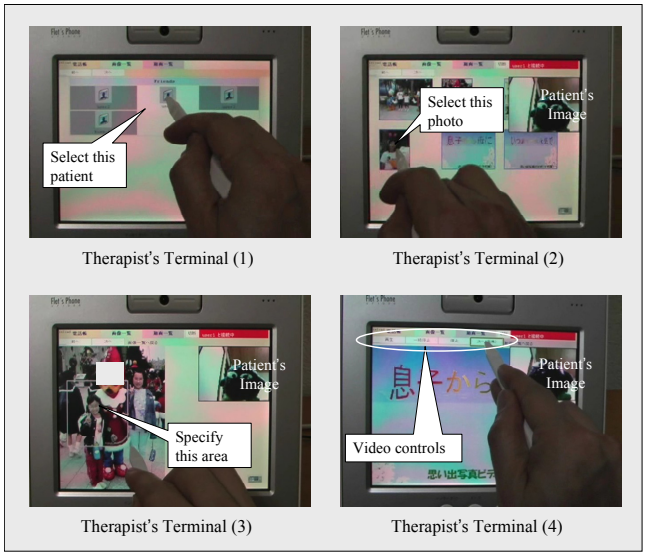

Figure 4. GUI examples of therapist's terminal

Figure 4 shows GUI examples of the therapist's terminal when the therapist chooses a patient to connect to (1). After the patient's terminal automatically received the call, the therapist selects the photo to be shared (2) and then specifies the rectangular region in which to perform panning and zooming (3). This operation's effect on the patient's terminal has already been presented in Fig. 3. Also, the GUI for controlling the video is shown in Fig. 4 (4). In this figure, the therapist started to play selected reminiscence videos for the patient on both terminals.

4. EXPERIMENTS

4.1 Talking with Dementia Patients by Videophones in Hospital

4.1.1 Purpose

Videophones play an important role in our proposed service. However, no studies have compared how long individuals with dementia can talk with partners over a videophone in networked sessions. To investigate this issue, we conducted an experiment on talking with dementia patients by videophone [15]. In the experiment, individuals with dementia were requested to reply to 20 prepared questions from a partner in videophone and face-to-face sessions. Total response times to these questions were compared between the two sessions, and we also evaluated subject eagerness to respond.

4.1.2 Method

Nine individuals (six males and three females) with mild and moderate dementia, who retained the ability to converse, were selected as subjects. They were diagnosed by their physicians (neurologists) as suffering from dementia. Their ages ranged from 65 to 75 and averaged 77. Their Mini Mental State Examination scores ranged from 10 to 25 and averaged 19 (mild dementia).

All 20 prepared questions were easy, common, and concerned their youth, hometown, family members, favorite foods, and school activities. The talking partner was a speech therapist (the third author).

An AB or BA design was applied. A was the videophone session, and B was the face-to-face session. The AB design was applied to five subjects, while BA was applied to the remaining four. Intervals between A and B ranged from a week to two months. The partner asked each subject the same 20 questions in both sessions. Facial expressions, gestures, and utterances were recorded with a digital video camera.

After asking each question, the partner passively listened to the replies without asking additional questions, just responding with such subtle gestures as nodding, smiling, or vague utterances including "Oh, I see." If the subject uttered nothing for five seconds and no additional comments were forthcoming, the partner proceeded to the next question. If the subject tried to utter further comments, the partner waited for ten more seconds. A maximum response time of two minutes was allocated to each question.

To evaluate subject eagerness to respond, 90-sec response scenes for all 18 sessions were extracted from the recorded scenes, and each subject's eagerness to respond to questions was measured using a five-degree psychological impression: 1 = uneager, 3 = normal, 5 = very eager.

Two speech therapy rooms in the hospital were used for this study. We used commercially available TV conferencing software that runs on a PC as well as 19-inch monitors, USB cameras, microphones, and speakers. We set up this equipment in each room. A face image approximately the same size as the real face of each person was displayed on a monitor. PCs were connected by LAN at a speed of 100 Mbps. Figure 5 shows a scene of the experimental setup, including therapist and patient.

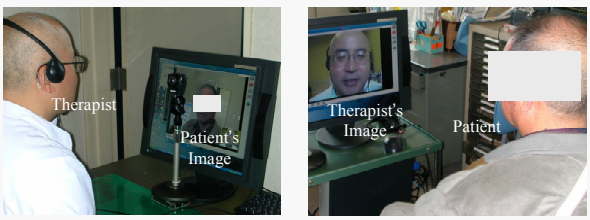

Figure 5. Experimental scenes

4.1.3 Results

The experimental hypothesis argued that there should be no difference in the total response time between videophone and

face-to-face sessions. The total response time of each subject for the two sessions was calculated. In the videophone sessions, the average response time was 16.5 minutes, but 14.1 minutes in the face-to-face sessions. These results demonstrate that no significant difference exists in the total response time between the two sessions. Figure 7 shows the total response time of each subject.

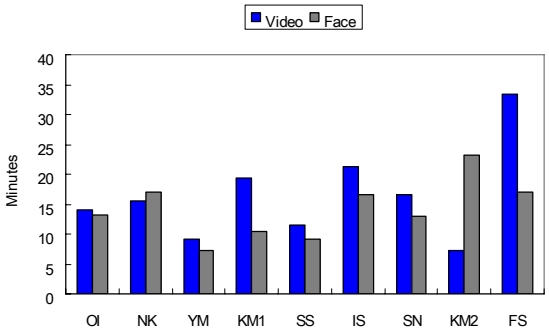

Figure 7. Total response time of each subject

For subject eagerness to respond to questions, the videophone sessions averaged 3.62 and the face-to-face sessions 3.55, indicating no significant difference in eagerness to respond. Figure 8 shows the average eagerness of each subject.

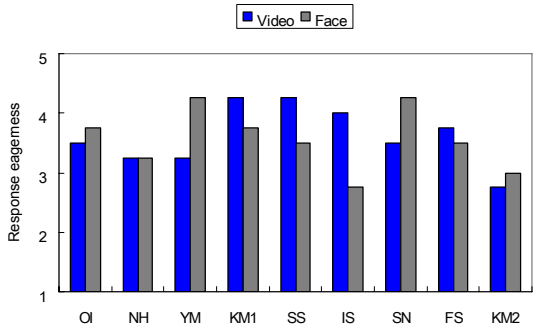

Figure 8. Eagerness to respond of each subject

4.2 Field Trial of Networked Reminiscence Therapy

4.2.1 Purpose

Based on the experimental results shown in the previous section, people with mild and moderate dementia could remotely talk with the therapist by videophone. We then conducted an experiment under a more realistic situation that included networked reminiscence therapy in collaboration with a telecom company, a senior care home company, and an NPO that dispatches volunteers for active listening with elderly people (including dementia patients). In this study, we intend to evaluate the effectiveness of a networked reminiscence session from the perspective of the impressions and satisfaction level of its participants. To measure such aspects of networked reminiscence therapy, we distributed a questionnaire to volunteers, home care staff, and family members of subjects about impressions and satisfaction level of networked reminiscence sessions compared with face-to-face sessions. The questions focused on system user-friendliness for both volunteers and subjects and serviceability for subjects. In addition, during both face-to-face and networked reminiscence sessions we shot videos of subjects for the purpose of further analysis of subjects' and volunteers' behaviors during face-to-face and networked sessions.

4.2.2 Method

A senior care home company provided two of its care facilities near Tokyo for this experiment and recruited dementia sufferers living in each facility as subjects after obtaining consent from family members. The severity of subjects' dementia ranged from mild to severe, and there were two subjects who were normal elderly. The NPO also recruited volunteers as talking partners for networked reminiscence sessions. Seven subjects (all female) and six volunteers (two males and four females) took part in, and finished this experiment. Table 1 shows profiles of each subject. Hasegawa score is the major indicator of severity of dementia in Japan.

Table 1 Profile of Each Subject

Subject	Age	Gender	Severity of Dementia	Hasegawa Score
A	85	female	Severe	4
B	90	female	None	22
C	90	female	None	29
D	71	female	Moderate	11
E	92	female	Severe	6
F	89	female	Mild	18
G	86	female	Severe	5

The experiment ran from the middle of April to the middle of June 2006. During the first few weeks, volunteers conducted face-to-face reminiscence sessions and selected photos to be used in networked reminiscence sessions that were stored in the Community Platform and used to produce reminiscence videos that were also used in this experiment. The telecom company provided IP videophones [16] and a broadband fiber-optic network communication line [17] for each subject and volunteer; but some volunteers used ADSL for technical reasons. Figure 9 shows scenes from the face-to-face and networked sessions. Since this subject has weak hearing, she used a bone conduction phone in both sessions.

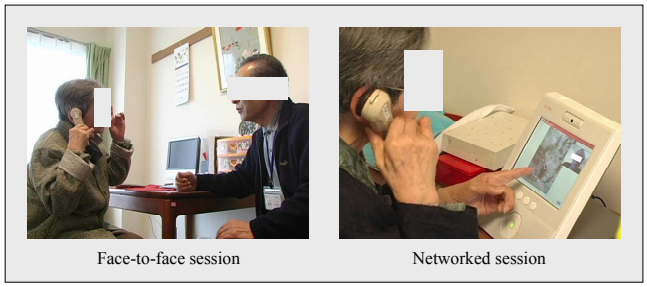

Figure 9. Experimental scenes

The total number of face-to-face sessions was fifteen, and from the beginning of May, networked reminiscence sessions started. Seventeen networked sessions were held with reminiscence content sharing and four without. Each session was about thirty minutes long, and at the end of each session we conducted a questionnaire survey (based on the SD method) of volunteers and home care staffs to gather their impressions of the sessions. After finishing this field trial, we also carried out a post facto

questionnaire survey that asked volunteers, home care staff, and family members of subjects about the usefulness of the provided functions for both volunteers and subjects and the serviceability of networked reminiscence therapy for subjects.

4.2.3 Summary of Each Subject's Response Evaluated by Home Care Staffs

First of all, we present Table 2 that summarizes each subject's response during the networked sessions evaluated by home care staffs based on the result of questionnaires and interviews with them. The cases of Subjects A and C were very successful, and Subject E might also be very successful if a content sharing function was available during her sessions. For Subjects D and F, networked sessions were successful with proper home care staff support.

On the other hand, the physical and mental conditions of Subjects B and G did not improve during the experiment period; networked sessions were not successful for them. Some home care staff said that the communication with the volunteer could not be established when the subject was deeply depressed, but they still wanted to continue the networked reminiscence therapy for them to see the long-term effects for Subjects B and G.

Table 2 Summary of Subject Responses Evaluated by Home care staff

Subject	Summary
A	Every networked session was very successful. She enjoyed conversations about the same set of her old photos.
B	Sometimes, she could not understand the video phone, and the networked session became difficult in such cases.
C	Every networked session was very successful, but sometimes, she complained about using the same photos in sessions.
D	Generally, she enjoyed the networked sessions, but sometimes, affective incontinence occurred in certain topics. In such cases, care staff's support was needed.
E	Although content sharing was not available in her networked sessions for technical reasons, she enjoyed conversations on her daily life in care home. However, the volunteer felt difficulty finding other topics when there's nothing else to talk about.
F	Generally, she enjoyed the networked sessions, but a strong desire to return home appeared in the session when she was deeply depressed.
G	She could not recognize her face in her old photos. She could not concentrate during the session. Care staff's support was necessary during the session.

4.2.4 Evaluating Impressions between Sessions by SD Method

The purpose of this analysis is to compare the impressions of volunteers and home care staffs between face-to-face and networked sessions. Based on the SD method, we designed the questionnaire by selecting 28 positive adjectives that represent impressions such as "Comfortable," "User-friendly," and so on. Each adjective had a negative counterpart, and volunteers and home care staffs evaluated each session by adjectives on a scale of one (negative) to five (positive). By using a principal factor method, we extracted a number of adjectives that represented impression factors, as shown in Table 3. Six factors were extracted, and Table 3 shows the top three whose cumulative contribution rate accounted for more than 50%. Each factor is represented by a number of adjectives, and Table 3 shows three typical adjectives for each factor. Based on the set of adjectives, we named these factors "Comfort," "Potency," and "Sophistication," as shown in Table 3.

Table 3 Extracted Factors

Factors (Top 3)	Cumulative Contributing Rate	Adjectives (Top 3)		
Comfort	33.62%	Gentle	Serene	Warm
Potency	47.76%	Powerful	Youthful	Energetic
Sophistication	55.08%	Elegant	Feminine	Beautiful

To compare impressions between face-to-face and networked sessions with/without reminiscence content sharing, Figure 10 shows the average scores of each type of session after projection on each factor space.

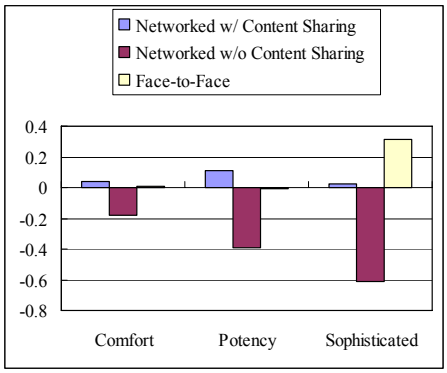

Figure 10. Comparison of Impressions of Each Type of Session

Compared to face-to-face and networked sessions with reminiscence content sharing, the networked session impression without reminiscence content sharing was worse. This indicates that the quality of communication by networked sessions without content sharing was worse than by face-to-face sessions, but content sharing compensated. Volunteers commented that content sharing helped find conversation topics and keep the subject's attention. We believe that these comments support our explanation of this result. However, there was no statistical difference of impression between types of session.

4.2.5 Evaluating Functions Provided for Networked Session by Using Post Facto Questionnaire

In the post facto questionnaire, we asked six volunteers whether they used the functions provided for networked sessions, and if so, were they useful from a score of one (useless) to four (useful). Figure 11 shows the rate of volunteers who used each function of the system and also the rate of volunteers who answered more than three points (slightly useful or useful) for each function of the system.

Although "Address Book" provided a one-touch interface for connecting TV phones, volunteers preferred conventional phone connections like pushing numbers. "Photo sharing" and "Pan & Zoom" of photos were used often by volunteers and were

considered useful. However, for "Video Sharing," some comments complained that this function was difficult to use during conversations with the subject due to a lack of content interactivity. Also, the "Pointing" function was used less by volunteers than "Pan & Zoom," but this function was designed for subjects. Therefore, we need to examine such subject behaviors as touching and pointing to the terminal's display by analyzing videos of experimental scenes to evaluate usefulness.

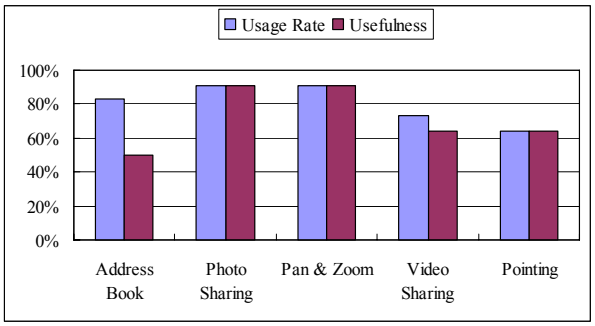

Figure 11. Usage Rate and Usefulness of Each Function Evaluated by Volunteers

5. DISCUSSION AND CONCLUSION

We have presented a system that allows elderly people with dementia (memory impaired) at home an equal opportunity to receive reminiscence therapy without time or spatial limitations, bringing them peace of mind.

Generally people with dementia are often said to confuse the person in the display with a real person. It is also thought difficult to communicate with such individuals using bi-directional video communication devices. However, based on our "Talking with Dementia Patients via Videophone in a Hospital" experiment, patients suffering mild and moderate dementia could communicate with the therapist by using the videophone, illustrating the potential of networked reminiscence therapy.

From field trial results presented in Sect. 4.2, networked reminiscence therapy worked well even for people with very severe dementia, although depressed subjects had difficulty establishing communication with volunteers. The care staffs said that the networked reminiscence therapy seemed to be suitable for elderly people with Alzheimer's dementia slowly progressed even though they were severe dementia, and that this therapy seemed to be difficult for elderly people with dementia caused by the cerebral trauma and the cerebrovascular disease.

Also, there were some subjects whose mental and physical conditions worsened due to the progression of dementia during the field trial. Consequently, they could not continue to take part in this trial; for these subjects, medical intervention should come first. However, for the subjects shown in Tables 2, this trial provided them good opportunities to attend social activities, and it generally stimulated them very positively. We and the home care staffs were all amazed that even subjects with very severe dementia (Subjects A and E in Sect. 4.2) understood the videophone function and looked forward to networked reminiscence therapy.

Furthermore, the networked reminiscence therapy will provide elderly people opportunities for being of assistance as talking partner (volunteer) to others even though they are physically handicapped and have the difficulty of visiting someone who need help. It will not only give them purposeful life but also make it possible to build a mutually-supportive society by broadening the base of volunteer activities of elderly people.

Through further analysis of the data obtained during the field trial (for example, subject behavior analysis using videos during sessions), we plan to statistically prove the effectiveness of networked reminiscence therapy and also to clarify more precisely what kinds of cases are suitable for it.

6. ACKNOWLEDGMENTS

We would like to thank NTT, Best Life Inc., the Association of Whole Family Care, and the participants of our experiments. We also would like to thank Koji Saito, Takeshi Ochi, and Kunihide Ikeda for the design and implementation of the services. This research was supported by the National Institute of Information and Communications Technology.

7. REFERENCES

[1] Davis, R. N., Massman, P. J., & Doody, R. S. Cognitive intervention in Alzheimer disease: A randomized placebo-controlled study. In *Alzheimer Disease and Associated Disorders, 15,* 2001, 1-9.

[2] Lund, D. A., Hill, R. D., Caserta, M. S., & Wright, S. D. Video Respite™: An innovative resource for family, professional caregivers, and persons with dementia. In *The Gerontologist, 35,* 1995, 683-687.

[3] Gormley, N., Lyons, D., & Howard, R. Behavioural management of aggression in dementia; A randomized controlled trial. In *Age and Aging, 30,* 2001, 141-145.

[4] Gräsel, E., Wiltfang, J., & Kornhuber, J. Non-Drug therapies for dementia: An overview of the current situation with regard to proof of effectiveness. In *Dementia and Geriatric Cognitive Disorders, 15,* 2003, 115-125.

[5] Murray, L. L., Dickerson, S., Lichtenberger, B., & Cox, C. Effects of toy stimulation on the cognitive, communicative, and emotional, functioning of adults in the middle stages of Alzheimer's disease. In *Journal of Communication Disorders. 36,* 2003, 101-127.

[6] De Vreese, L. P., Neri, M., Fioravanti, M., Belloi, L., & Zanetti, O. Memory rehabilitation in Alzheimer's disease; A review of progress, In *International Journal of Geriatric Psychiatry, 16,* 2001, 794-809

[7] Alm, N., Astell, A., Ellis, M., Dye, R., Gowans, G., & Campbell, J. A cognitive prosthesis and communication support for people with dementia. In *Neuropsychological Rehabilitation, 14,* 2004, 117-134.

[8] Kuwabara, K., Tetsutani, N., Kuwahara, N., Kawato, S., Lyons, M. J., Utsumi, A., Yanagida, Y., and Yasuda, K. Networked Interaction Therapy: Supporting People with Mild Dementia and their Family Members with Internet, In *20th International Conference of Alzheimer's Disease International Kyoto 2004, Abstracts,* 2004, p. 377

[9] Finnema, E., Droes, R.M., Ribbe, M., & Van Tilburg, W. The effects of emotion-oriented approaches in the care for persons suffering from dementia: A review of the literature. In *International Journal of Geriatric Psychiatry, 15,* 2000, 141-161.

[10] Yasuda, K., et al. Reminiscence Video for Higher Brain Dysfunctions, In *Proceedings of General Conference of Japan Society for Higher Brain Dysfunctions,* 2004 (in Japanese).

[11] Kuwahara, N., Kuwabara, K., Abe, S., Yasuda, K., and Tetsutani, N. Semantic Synchronization: Producing Effective Reminiscence Videos, In *4th International Semantic Web Conference (ISWC2005), Demo Papers,* 2005.

[12] Kuwahara, N., Kuwabara, K., Abe, S., Susami, K., and Yasuda, K. A Method for Producing Reminiscence Video by Using Photo Annotations –Application and Evaluation for Dementia Sufferers, In *Journal of The Japan Society for Artificial Intelligence, 20, 6,* 2005, 396-405 (in Japanese).

[13] Kuwahara, N., Kuwabara, K., and Abe, S. Networked Reminiscence Content Authoring and Delivery for Elderly People with Dementia, In *Proceedings of International Workshop on Cognitive Prostheses and Assisted Communication*, 2006.

[14] Kuwahara, N., Kuwabara, K., Abe, S., Tetsutani, N., and Yasuda, K. The Evaluation of Audio-Visual Effects added to a Reminiscence Video for dementia sufferers, In *Proceedings of SI2005*, 2005 (in Japanese).

[15] Yasuda, K., Kuwabara, K., and Kuwahara, N.: *Talking with Individuals with Dementia on a Video Phone: A Preliminary Study for Networked Interaction Therapy*, Proceedings of International Workshop on Cognitive Prostheses and Assisted Communication (2006)

[16] http://www.fletsphone.com/index_f.html (in Japanese)

[17] http://flets.com/index.html (in Japanese)