

**DAILY LIVING SUPPORT SYSTEM FOR MEMORY-IMPAIRED  
PEOPLE BY USING CONTENT DELIVERY WITH VIDEO AND  
VOICE OVER IP**

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**Abstract.** Providing good care at home to people with dementia is becoming an important issue as the elderly population increases. A major problem in providing such care is that it must be constantly provided without interruption, which puts a great burden on caregivers, who are often family members. *Networked Interaction Therapy* is what we call our methods designed to relieve the stress of people suffering from dementia as well as their family members. In this paper, we give an overview of *Networked Interaction Therapy* that supports the daily living of memory-impaired people by media technology. Then, we show that it is very promising, although there remain some points to consider when it is applied to patients.

## **1. Introduction**

Providing a high standard of care for people with dementia (patients) is becoming an increasingly important issue as societies continue to age. At the same time, supporting the daily living of patients by handling various related behavioral disturbances, such as wandering, agitation, illusions, and incontinence, puts a great burden on caregivers, who are often family

members (Davis et. al., 2001). In order to relieve their stress, we are developing *Network Interaction Therapy*, which enables software agents and remote volunteers to communicate with patients at home via the Internet and to thus support their daily living. Over the past few years, we have focused on emotional aspects to prevent behavioral disturbances of patients. Reminiscence therapy is reported to bring peace of mind to patients and to help reduce behavioral disturbances (Gräsel et. al., 2003). Despite its effectiveness, reminiscence therapy is difficult to perform at home due to a shortage of experienced staff. Therefore, we provided patients with reminiscence videos (Kuwahara et. al., 2005) and developed a system for conducting reminiscence therapy with the patient at home by a remote therapist using ICT (Kuwahara et. al., 2006).

On the other hand, some patients and family caregivers want to support patients' independent life by using ICT for tasks such as schedule management of medicine dosing and hospital visits, route guidance while going out, and so on. "Memory Assist" (Memory Assist, 2004) is a device that was developed for this purpose by the National Rehabilitation Center for Persons with Disabilities in Japan. However, patients often lose their motivation to do things for themselves, depending on their mental condition. In such cases, they neither follow the schedule presented by a device nor listen to their family caregivers. There is a report on an approach where the therapist successfully led patients to follow their schedule by playing music and recorded voices of the therapist on a voice recorder (Yasuda et. al., 2006). Based on this idea, we are now developing a schedule management system that delivers contents intended to gain patients' willingness to perform scheduled tasks before actually presenting the schedule.

In this paper, we briefly introduce our proposed *Networked Interaction Therapy*. Then, we explain the services that it implements and present the benefits and limitations of these services based on experiments. Furthermore, we present the field experiment we are now conducting in collaboration with Chiba Rosai Hospital.

## **2. Networked Interaction Therapy for Memory-Impaired People**

### **2.1 REQUIREMENTS OF PATIENT AND FAMILY CAREGIVER**

In order to design services based on *Networked Interaction Therapy*, we conducted requirement analysis through group interviews with professional and family caregivers (Kuwahara et. al., 2004). We presented possible scenarios of *Networked Interaction Therapy* for coping with troubles in a patient's daily living and helping him/her and his/her family caregiver. Then,

we asked the interviewees whether our proposed scenarios seemed beneficial for both the patient and his/her family caregiver. According to the analysis results of these interviews, we found that the following services were eagerly desired by caregivers.

1. Holding patient's attention for a while in order for family caregiver to take a short respite.
2. Preventing behavioral problems of the patient.
3. Increasing chances of communication between the patient and his/her acquaintances (volunteers).
4. Schedule management of patient's daily living.

## 2.2 CORE SERVICES OF NETWORKED INTERACTION THERAPY

In order to meet the above requirements, we have developed the following core services of *Networked Interaction Therapy*.

**Reminiscence Video Service:** For holding the patient's attention, this service delivers a reminiscence video to the patient and provides family caregivers with a way to produce attractive video by using the patient's old photos. The reminiscence video has also been proven to prevent behavioral problems.

**Networked Reminiscence Therapy Service:** For increasing the chances of communication between the patient and his/her acquaintances (volunteers), this service provides him/her with easy access to a videophone. In order to involve the patient in conversations deeply, interactive reminiscence content-sharing is available during the conversation to stimulate his/her memory.

**Schedule Management Service:** For patient's schedule management such as medicine dosing, hospital visits, and so on, this service delivers the patient not only his/her schedule but also, before even presenting the schedule, contents for gaining the patient's willingness to perform the scheduled tasks. Moreover, this service is able to invoke the above services according to the patient's schedule.

In the next section, we describe these services in more detail and present their benefits and limitations based on experiments we conducted.

### 3. Development and Evaluation of Core Services

#### 3.1 REMINISCENCE VIDEO

Reminiscence video has been experimentally proven to bring dementia patients peace of mind (Kuwahara et. al., 2005a). It 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 containing the person the patient is interested in as shown in figure 1, and the former include background music (BGM) and suitable narration to make the video more engaging. These effects are applied to each photo based on the meta-data annotated by the video author beforehand (Kuwahara et. al., 2005b). We provided family caregivers with an authoring tool for easily producing various versions of reminiscence videos by simply choosing the set of photos.

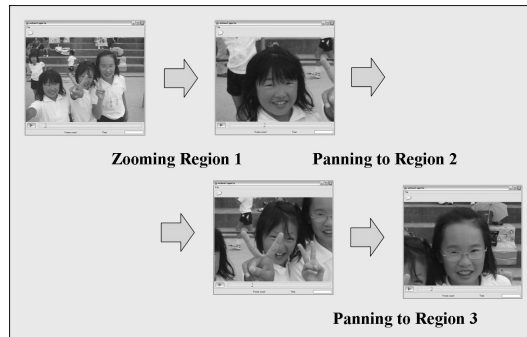


Figure 1. Example of Reminiscence Video (Patient's daughter on her school festival day).

Through our experiments, family caregivers were very pleased that patients' utterances increased when they watched reminiscence videos. Family caregivers said that their compassion for patients returned to them. This showed that reminiscence video is not only useful for holding a patient's attention for a while but also can be a trigger for renewing past ties between the patient and his/her family members (Kuwahara, 2007). However, we noticed some problems that still need to be overcome. For instance, some patients felt uncomfortable with the photos we chose because these photos evoked their sad memories. We also examined the importance of audio-visual effects for bringing patients' peace of mind. Based on subjective evaluations of family caregivers who observed patients' reactions while watching

reminiscence videos, narrations were considered very important in holding patients' attention. Zooming and panning were also effective, but BGM seemed to be less important than these effects.

### 3.2 NETWORKED REMINISCENCE THERAPY

A reminiscence therapy session is usually conducted in a group led by experienced staff at institutions. In a reminiscence therapy session, a therapist prepares old tools, toys, photos, and paintings to effectively stimulate memories. To provide patients at home with an equal opportunity to receive this therapy's benefits, we developed a system for networked reminiscence therapy by using a videophone (Kuwahara et. al., 2006). In order to ensure that the patient remains engaged in the networked reminiscence session, our approach incorporates videophone and reminiscence content sharing. Our intention is to produce similar effects to those experienced in a face-to-face reminiscence session by photo and video sharing. We conducted the experiment in collaboration with a telecom company, a senior home-care company, and an NPO that dispatches volunteers to help elderly people. The right side of figure 2 shows a scene of our experimental set-up.

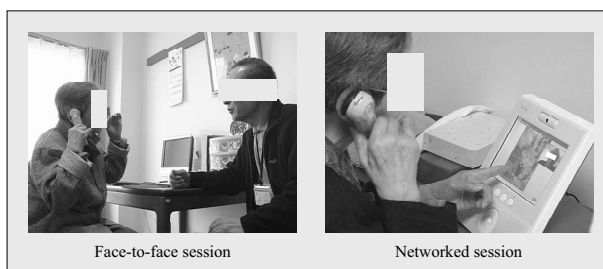


Figure 2. Experimental set-up of Networked Reminiscence Therapy (right).

We reported on a case where even a patient with very severe dementia enjoyed the conversation via videophone and content sharing with a remote volunteer (Kuwahara et. al., 2006). This result seemed to be comparable to that of a face-to-face session. On the other hand, patients with even mild or moderate dementia, if they developed mood disorder, sometimes lost emotional control when viewing reminiscence contents that brought back memories of difficult times in their lives. In such cases, remote volunteers could do nothing until the caregiver beside the patient calmed the upset patient. Therefore, remote volunteers should be very careful in selecting the topics and contents shared with patients. Otherwise, it would be safe to

conduct remote therapy under the situation where a family caregiver can intervene in the session if the patient suffers an episode of bad memories.

### 3.3 SCHEDULE MANAGEMENT

Figure 3 illustrates an overview of the services provided by the scheduled management system we have developed. Our system is implemented via a server on the Internet. Therefore, the family caregiver can ask the remote volunteer to input the patient's schedule if she/he is having difficulty in operating the local PC.

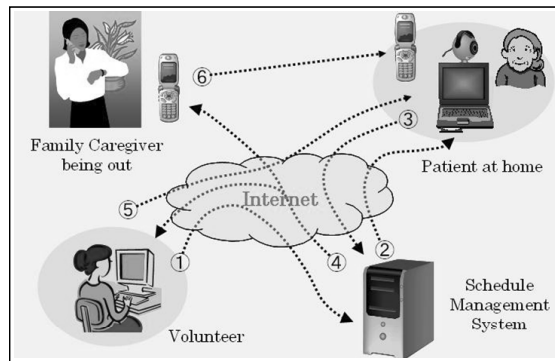


Figure 3. Service overview of schedule management system for patients.

After the volunteer inputs the patient's schedule (① in figure 3), the server delivers the content that encourages the patient's willingness to perform a scheduled task before presenting her/his schedule on the patient's PC (②). Medicine dosing is important for maintaining the patient's health; therefore, the content delivered to the PC induces the patient to take her/his medicine in front of the PC. Then, the system shoots video with the Web camera as evidence of the patient's taking the medicine. This video is sent to the server (③), allowing the family caregiver (who is now out of the home) and the volunteer to check it (④). If the patient does not take her/his medicine at the scheduled time, the volunteer or the family caregiver can call the patient by using the IP videophone or a cellular phone (⑤, ⑥). We are now preparing more than ten kinds of contents, including dosing, meals, bathing, and so on.

We have just started to conduct a field experiment to evaluate the effectiveness of our system in patients' daily lives. This experiment is briefly introduced in the next section.

#### 4. Field Experiment with Patient at Home

Compared to our earlier experiments, this field experiment is more challenging in the way that the system is used in the patient's daily living, since it is designed to support him/her for 24 hours. Work on the first case of the experiment has just finished. The subject in this case was an 87-year-old female living with her family. Family members said that she suffers from moderate memory impairment. For instance, she frequently forgets to take medicines, to eat meals, and so on. Also, she usually forgets what she was just told. So far, no problem of disturbing behavior has been observed. We set the service terminal (PC) at her home. The terminal notifies her of her schedule along with related contents. This terminal also provides her with the reminiscence video and the remote reminiscence therapy to bring her the piece of mind and to give her more opportunities to communicate with her acquaintances. Figure 4 shows part of the patient's schedule and a scene from the experiment. She used our service for about ten days.

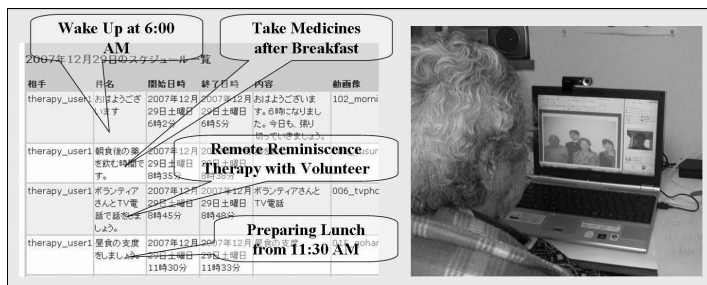


Figure 4. Example of patient's schedule and experimental scene.

We evaluate the benefit of this service from the viewpoint of how well the patient follows notifications from the system comparing with reminders by her family caregivers. Therefore, her family caregivers recorded whether she followed notifications from the system or not during the experiment. So far, our system has guided her more successfully than reminders by her family caregivers. For instance, medicine dosing at early-evening improved 33% to 57%, dosing before sleep improved 25% to 28%, preparing lunch improved 55% to 85%, and so on.

We plan to conduct this field experiment with three more subjects by the end of this fiscal year. However, for patients and family caregivers who think that this service is beneficial and want to continue to use it, we will provide them with this service beyond the experimental period.

## 5. Conclusions

In this paper, we introduced *Networked Interaction Therapy* and the services it implements. Although there remain problems to be overcome before implementing full-fledged services, the evaluation results of these services provided by *Networked Interaction Therapy* have been promising so far. Moreover, the field experiment seems to have proceeded as we expected, although we have finished work on only one case. We hope that *Networked Interaction Therapy* will not only provide some respite to caregivers (family members of patients) from round-the-clock care but also bring them and their loved ones meaningful moments to share good memories and to live an independent life with dignity, thus improving the quality of their lives.

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