

# DEVELOPING ELDERLY STRESS-RELIEF SERVICE USING PERSONALIZED VIDEOS AND SPOKEN DIALOGUE AGENT

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## ABSTRACT

*Our research group is conducting research of a system to support the lives of the elderly at home. We developed "Rakuraku Video Service" (Rakuraku means easy.), a service that obtains information on the interests and preferences of elderly people and recommends YouTube videos based on this information. The purpose of this service is to help the elderly relieve stress and relax by watching videos. However, it has not been tested yet whether this service has such an effect on the elderly. We conduct an experiment to evaluate the service. In conducting the experiment, we will collaborate with a previous study, "PC-Mei" which aims to watch over the elderly and support their daily lives with a virtual agent. The experiment was conducted to obtain evaluations of watched videos and a questionnaire. From the results, it is clear that the service is useful in relieving stress among the elderly.*

## KEYWORDS

*Elderly at home, watching videos, stress relief, individual adaptive type, spoken dialogue agent.*

## 1. INTRODUCTION

In recent years, Japan's population has been aging, and the country is facing a super-aged society. As a result, the number of people requiring nursing care has been increasing, but a shortage of nursing care workers has become an issue. In response to this problem, the government is working to establish a comprehensive community care system that allows elderly people to continue to live in their own neighborhoods even after they require nursing care. One of these efforts is the establishment of a system of home nursing care and home medical care. As a result, the number of elderly people living at home is expected to increase in the future.

Our research group has been developing a system to watch over elderly people at home [1]

[2] [3] [4]. In our previous research, we have been working on the development of the "Rakuraku Video Service" (Rakuraku means easy.) [5] [6] [7], which aims to relieve the stress of the elderly. Rakuraku Video Service is a service that recommends YouTube videos suited to individuals based on their answers to a questionnaire about their interests and preferences. The screen is designed so

that even the elderly, who are not good at operating digital devices, can easily operate the service. The aim of this service is to provide users with stress relief and relaxation by watching videos that suit their personal preferences. Preliminary experiments with faculty members and students belonging to our research group have confirmed that this service can recommend videos suited to individual users, but the effect on the elderly has not yet been verified.

In this paper, we conduct a demonstration experiment of Rakuraku Video Service for the elderly and evaluate the service. The following research questions are set for the verification experiment.

- RQ1 : Can the service recommend videos that match the interests and tastes of the elderly?
- RQ2 : Is the service easy for the elderly to operate?
- RQ3 : Can the elderly relieve stress by watching videos recommended by the service?

The experiment targets three elderly people in their 70s to 80s, and the duration is two weeks. In order to conduct the experiment, we collaborated with PC-Mei [8] [9], a system that uses a spoken dialogue agent to support the monitoring of daily life. Subjects are asked to invoke and use Rakuraku Video Service by voice operation of PC-Mei. The service was evaluated by evaluating the recommended videos and by a questionnaire after the experiment. The results showed that the system can recommend videos that match the interests and preferences of the elderly, that the operation is easy for the elderly, and that viewing the recommended videos has a stress-relieving effect. On the other hand, it was also found that there is room for improvement in the video recommendation algorithm and operation method. Future tasks are to improve the system and conduct experiments with a larger number of subjects.

## **2. PRELIMINARIES**

### **2.1. The Elderly and Stress**

The world's population aging rate is currently rising; in 2020, it was 9.3%, and it is expected to rise to 17.8% by 2060. By country, Japan currently has the highest rate of aging. 28.9% of the population will be elderly in 2021, and the country is entering a hyper-aged society.

While the number of people requiring nursing care is rising with the aging of society, there is a shortage of nursing care workers. In response, the government is working to build a comprehensive community care system that allows elderly people to continue to live their own lives in their own neighborhoods until the end of their lives, even if they require nursing care. One of these efforts is the establishment of a system of home nursing care and home medical care. Therefore, the number of homebound elderly people is expected to increase in the future. Long time spent at home may cause stress due to loneliness and worries about life and health. While living at home, homebound elderly people need to engage in self-care to relieve their own stress without placing a burden on their families and caregivers.

### **2.2. Preceding Research: Rakuraku Video Service**

Our research group has been conducting research and development of a system to watch over and support elderly people at home. We are developing a "Rakuraku Video Service" (Figure 1, Figure 2) [5] [6] [7] to relieve the stress of elderly people at home. This service recommends personalized YouTube videos based on the user's interests and preferences obtained through questionnaires, and aims to relieve stress and relax the user by having him or her watch them. The screen is designed to be easy to operate, even for those who are not good at operating digital

devices. The service has the following three functions.

**Video playback function** This section describes a function that automatically plays videos on YouTube sequentially when a list of videos is given. When a list of videos and a user are registered with the service, a URL for playing the videos is generated for each user. Users can access the URL to start viewing the videos. The video playback screen is shown in Figure 1.

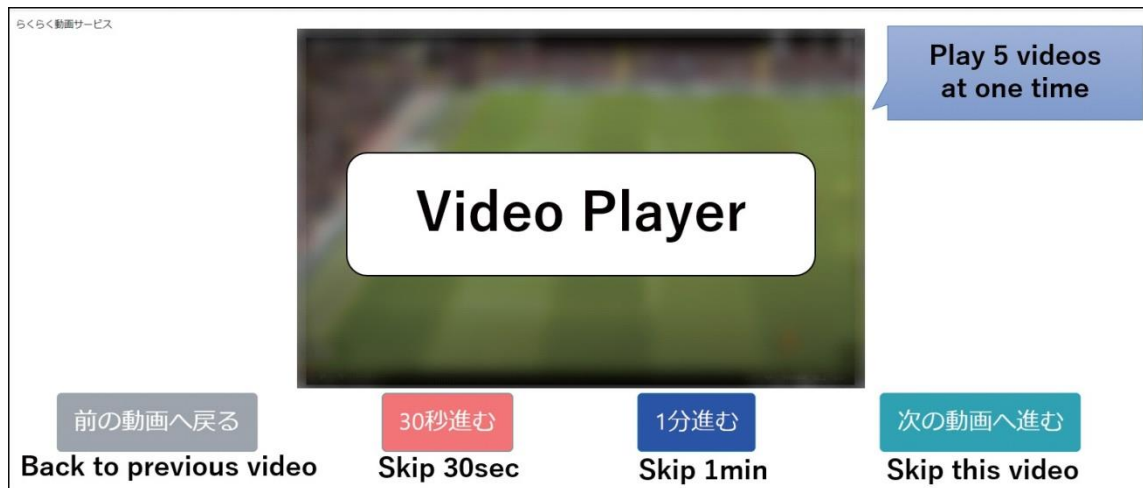


Fig. 1. Rakuraku Video Service (video playback screen)

**Video list creation function** This section describes the functionality used to create a list of videos tailored to the user's tastes and preferences. First, we obtain information on users' tastes and preferences using paper media and Google Forms. The questionnaire includes "favorite places and places to visit", "favorite music (singers and songs)", "favorite sports and athletes", "favorite celebrities", "hobbies", "favorite TV and radio", and "old favorites and other interests". Each answer is entered into the service as a search word for YouTube videos, and the search program automatically searches for videos that match the individual's preferences. The searched videos satisfy the following conditions.

- Video must be within the top 5 videos related to the search term in order of number of views and relevance.
- Video must have at least 10,000 views on YouTube
- Video length must be less than 20 minutes.

The limitation by the number of views was established because preliminary experiments conducted with faculty members and students in the research group revealed that videos with fewer views tended to be rated lower by users. A limit on the length of videos is set because we believe that elderly people will not be able to concentrate for long periods of time. Searched videos are automatically registered with the service. The service also selects five registered videos and registers them as a list. The videos selected are one from each genre (singers, sports, hobbies, etc.). When a user finishes watching one list, a new list of videos is automatically registered.

**Effectiveness measurement function** This section describes the function for measuring the impact of video viewing on the elderly. The purpose of this service is to relieve stress, but since it is difficult to actually measure the degree of stress relief, this service obtains subjective evaluations of videos. Immediately after viewing a video, users are asked to rate the video in 5 levels: "Interesting", "Slightly Interesting", "Neutral", "Not Very Interesting", and "Not Interesting" by pressing a rating button. The video evaluation screen is shown in Figure 2. In addition, facial expression recognition during video viewing is used to provide an objective evaluation of the video. Facial expression

recognition captures changes in facial expression by capturing the width of the mouth and the movement of the eyes. However, in this experiment, facial expression recognition is not performed for the sake of subject privacy.

Fig. 2. Rakuraku Video Service (video evaluation screen)



Fig. 3. PC-Mei Copyright 2009-2018 Nagoya Institute of Technology (MMDAgent Model “Mei”)

### 2.3. Preceding Research: Pc-Mei

.Our research group has been developing PC-Mei ( Figure 3 ) [8] [9], a system that uses a spoken dialogue agent to support the monitoring of the elderly in their daily lives. In the previous study, we developed a service voice execution function that enables PC-Mei to execute various services on the Web as an extension of this system. The system executes services when an elderly person utters specific keywords. Examples include a search service that performs Web searches using keywords and a weather forecast service that tells the user the weather forecast. This function allows the elderly to easily use Web services by voice without complicated device operations

## 2.4. Linking PC-Mei with Rakuraku Video Service

To link the previous studies, we register Rakuraku Video Service to PC-Mei's service voice execution function. This allows users to easily access the service startup screen by saying "Rakuraku Video Service" to the PC-Mei agent. The figure 4 shows the overall architecture after the linking.

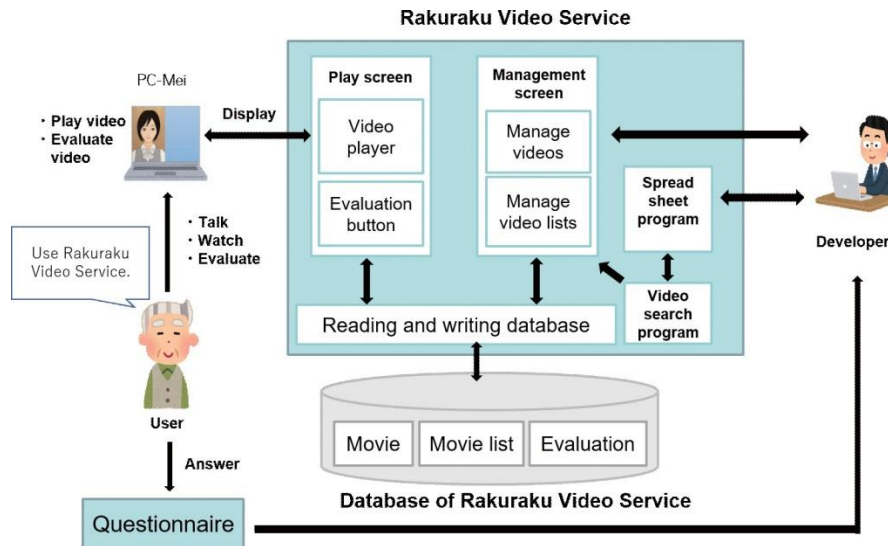


Fig. 4. Overall Architecture

Rakuraku Video Service manages and plays videos, and PC-Mei calls and displays the video playback screen.

## 2.5. Issues to Focus on

We have conducted preliminary experiments on Rakuraku Video Service with faculty members and students belonging to our research group, and verified that the service can recommend videos that match individual tastes and preferences. However, it has not yet been verified whether the recommendation of preferred videos to the elderly can relieve stress and relax them. In this paper, we propose to investigate the impact of this service on the elderly, and conduct a demonstration experiment on the elderly as a research method.

## 3. EXPERIMENT

### 3.1. Purpose of Experiment

The purpose of this experiment is to evaluate Rakuraku Video Service through an experiment targeting elderly people. The following research questions were set up for the evaluation.

- RQ1: Can the service recommend videos that match the interests and tastes of the elderly?
- RQ2 : Is the service easy for the elderly to operate?
- RQ3 : Can the elderly relieve stress by watching videos recommended by the service?

### 3.2. Method of Experiment

This experiment will be conducted with three elderly subjects in their 70s and 80s, and a PC-Mei system linked to Rakuraku Video Service will be installed in each of their homes. The subject

Table 1. Subject Information

Subject	Gender	Age	Household
Subject A	woman	80's	solitarily living alone
Subject B	woman	80's	solitarily living alone
Subject C	man	70's	elderly only

used the service by saying "Rakuraku Video Service" to PC-Mei at any time during a two-week period.

The experimental procedure is as follows.

- Step 1 :** The subject's basic information (name, etc.) is registered with Rakuraku Video Service and PC-Mei.
- Step 2 :** The PC-Mei (laptop computer) is installed in the subject's home.
- Step 3 :** A questionnaire regarding the subjects' hobbies and preferences is administered
- Step 4 :** Enter the answers to the questionnaire into Rakuraku Video Service and run the video search program
- Step 5 :** The subject says "Rakuraku Video Service" to the PC-Mei agent at an arbitrary time
- Step 6 :** Subjects watch five videos at a time and rate each video on a five-point scale.
- Step 7 :** The service updates the video list when the viewing of a video is finished.
- Step 8 :** Perform Step 5 to Step 7 for 2 weeks.
- Step 9 :** The system is collected and a post-experiment questionnaire is administered.

The post-experiment questionnaire asks the following questions. Except for Question 6, the answers were selected from 1 to 4 (1: not applicable, 2: not very applicable, 3: a little applicable, and 4: applicable). The respondents are also asked to provide reasons for each answer, if any

#### Questionnaire after the experiment

- Q1: I had a good time using this service.
- Q2 : I felt nostalgic using this service.
- Q3 : I felt the effects of stress reduction and relaxation by using this service.
- Q4 : This service was easy to operate.
- Q5 : I would like to use it again if I have a chance.
- Q6 : Please write down any improvements or comments.

## 4. RESULTS

The table 2 shows the number of times each subject used Rakuraku Video Service and the number of videos viewed. 3 subjects used the service a total of 21 times and viewed 47 different videos.

Although 5 videos were played back per use, only 47 different videos were viewed as a result because the videos were selected at random from among the videos searched for, resulting in the same video being viewed multiple times.

Table 2. Experimental results: Number of times used

Subject	Number of times used	Number of video types viewed
Subject A	1	5
Subject B	14	25
Subject C	6	17
Total	21	47

The table 3 shows the results of the subjects' evaluations of the videos (the number of each evaluation). When the same video was viewed and evaluated multiple times, the results are shown for the first viewing. 22 videos were interesting, 8 were lightly interesting, 10 were neutral, 3 were not very interesting, and 4 were not interesting for all three subjects.

Table 3. Experimental results: Evaluation for videos(unit: number of videos)

Subject	Interesting	Slightly Interesting	Neutral	Not Very Interesting	Not Interesting
Subject A	4	0	0	1	0
Subject B	10	6	4	1	4
Subject C	8	2	6	1	0
Total	22	8	10	3	4

Table 4. Post-experiment questionnaire results

(Refer to Step 9 of the Method of Experiment for the selection scale of 1 to 4.)

Question	Subject A	Subject B	Subject C
Q1	3	4	4
Reason	It was unfortunate that the publicity ran.	I was glad to see my favorite singer on the program.	It was nice to hear some of the old songs.
Q2	No answer	1	4
Reason	No answer	No answer	The old songs made me feel nostalgic.
Q3	2	4	4
Reason	No answer	I used it when I had time.	It was nice to see old songs and golf videos.
Q4	3	2	4
Reason	No answer	I was anxious to push in the wrong place. The buttons were easy to understand.	I was a little confused when I had to go back, but overall it was good.
Q5	No answer	4	4
Reason	No answer	I would like to use it by all means.	I would like to use it if you call on me.
Q6	It would have been nice if they played karaoke or enka.	Loved to hear the songs.	I would like to see a longer video (about an hour).

## 5. DISCUSSION

### 5.1. Discussion of RQ1

In order to examine whether or not the service was able to recommend videos that matched the tastes and preferences of the elderly, we assigned a score to the evaluation given to each video. We assign a score of -2 points to "Not Interesting", -1 point to "Not Very Interesting", 0 points to "Neutral", 1 point to "Slightly Interesting", and 2 points to "Interesting". From the table 3, the

average score of the 47 videos viewed and evaluated was calculated to be 0.87, which was closer to "Interesting" than to "Neutral". Thus, for RQ1, we confirmed that Rakuraku Video Service is capable of recommending videos that match the interests and tastes of the elderly.

## 5.2. Discussion of RQ2

The results of Q4 of the post-experiment questionnaire are discussed in terms of whether the operation was easy for the elderly. One subject answered "not very applicable" to the question of whether the operation was easy. The subject stated that the buttons were easy to understand, although he felt uneasy when he pressed different buttons (in unrelated places). The remaining two subjects answered "a little applicable" and "applicable," confirming that the current screen design and operation methods are easy for the elderly, although there is room for improvement.

## 5.3. Discussion of RQ3

The results of Q1, Q2, and Q3 of the post-experiment questionnaire will be used to determine whether viewing the recommended videos relieves stress in the elderly. All subjects answered that Q1 (I had a good time using this service.) was applicable or a little applicable. Regarding Q3 (I felt the effects of stress reduction and relaxation by using this service.), two out of three subjects answered applicable. The above results confirm that using RakuRaku Video Service makes the users feel happy, stress-relieving, and relaxing. However, one subject said that they were disappointed with the advertisements, indicating that the video search program needs to be improved. Q2 (I felt nostalgic using this service.) was set as a question in the post-experiment questionnaire because we thought that if there were things from the past in the answers to the questionnaire about interests and preferences, videos that made the participants feel nostalgic would be recommended. One of the methods of dementia care is reminiscence [10], which aims for psychological stability by reminding people of the past. We expected a relaxing effect of nostalgia based on this method, and it can be said that it had that effect only on Subject C. We believe that this effect can be improved in the future by asking about past events in more detail during the questionnaire.

## 5.4. Discussion of Video Evaluation

We investigated what genres of videos were likely to receive good evaluations. Here, as shown in the table 5, we consider the survey items related to tastes and preferences as seven genres.

Table 5. Dividing into genres

Questionnaire item	Genre
favorite places and places to visit	Place
favorite music (singers and songs)	Music
favorite sports and athletes	Sport
favorite celebrities	Celebrity
hobbies	Hobby
favorite TV and radio	Program
old favorites and other interests	Interest

The table 6 shows the results (rounded to two decimal places) of calculating the percentage of ratings for each genre. (e.g. The genre "Place" was watched three times in total, and two were rated as interesting. Therefore, the ratio is  $2 \frac{3}{5} \doteq 0.67$ )

The table 6 shows that music, celebrity, and program were highly rated as interesting or slightly interesting. This is thought to be due to the fact that the answers to the questionnaires for the interests



and tastes are concrete names and proper nouns, and therefore, videos that match individual tastes are easily recommended. On the other hand, a high percentage of respondents rated sport videos as neutral, not very interesting, or not interesting. This is thought to be due to the fact that even when searching for videos on a single sport, there are so many different types of videos that it is unlikely that a video suited to the individual will be recommended. The same can be said for hobby, which have a large variation in evaluation. For other genres, the number of videos viewed was small, so it is necessary to conduct experiments with a larger number of subjects.

Table 6. Percentage of evaluation by genre

Genre	Interesting	Slightly	Neutral	Not Very	Not	Total
	Interesting		Interesting (unit: number of videos)			
Place	0.67	0	0.33	0	0	3
Music	0.75	0.19	0.06	0	0	16
Sport	0	0.13	0.38	0.25	0.25	8
Celebrity	0.67	0.33	0	0	0	3
Hobby	0.38	0.13	0.13	0.13	0.25	8
Program	0.60	0.40	0	0	0	5
Interest	0	0	1.00	0	0	4

### Future issues

As mentioned in the discussion above, future issues are to improve the screen design so that even those who are not familiar with the operation of digital devices can clearly understand how to operate them, and to conduct the experiment with a larger number of subjects. In addition, since there were cases in which the same video was viewed multiple times in this experiment, it is necessary to modify the video recommendation algorithm in order to recommend different videos.

## 6. CONCLUSION

In this paper, we conducted a demonstration experiment with elderly people to evaluate Rakuraku Video Service that helps elderly people relieve stress. From the experimental results, we confirmed that the service can recommend videos that match the interests and tastes of the elderly, that it is easy to operate, and that it can help them relieve stress. We also confirmed that the evaluation of the service is biased depending on the genre of the videos.

The issues found in the experiment are to design a screen that is easier to understand the operation method, to improve the video recommendation algorithm, and to conduct an experiment with a larger number of subjects. The service will be improved based on the results of this experiment. This will enable elderly people at home to easily watch videos that match their interests and tastes, and is expected to help them relieve stress.

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