Advances in Intelligent Systems and Computing 483

WonJoon Chung Cliff Sungsoo Shin *Editors* 

# Advances in Affective and Pleasurable Design

Proceedings of the AHFE 2016 International Conference on Affective and Pleasurable Design, July 27–31, 2016, Walt Disney World<sup>®</sup>, Florida, USA



# Advances in Intelligent Systems and Computing

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WonJoon Chung · Cliff Sungsoo Shin Editors

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Proceedings of the AHFE 2016 International Conference on Affective and Pleasurable Design, July 27–31, 2016, Walt Disney World<sup>®</sup>, Florida, USA



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# Advances in Human Factors and Ergonomics 2016

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Tareq Z. Ahram, Florida, USA Waldemar Karwowski, Florida, USA

#### 7th International Conference on Applied Human Factors and Ergonomics

Proceedings of the AHFE 2016 International Conference on Affective and Pleasurable Design, July 27–31, 2016, Walt Disney World<sup>®</sup>, Florida, USA

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Advances in Human Factors in Cybersecurity	Denise Nicholson, Janae Lockett-Reynolds and Katherine Muse

(continued)

### Preface

This book focuses on a positive emotional approach in product, service, and system design and emphasizes aesthetics and enjoyment in user experience. This book provides dissemination and exchange of scientific information on the theoretical and practical areas of affective and pleasurable design for research experts and industry practitioners from multidisciplinary backgrounds, including industrial designers, emotion designer, ethnographers, human–computer interaction researchers, human factors engineers, interaction designers, mobile product designers, and vehicle system designers.

This book is organized in seven sections which focus on the following subjects:

- I. Design of Human Interface and Affective Communication
- II. Kawaii/Affective Value Creation
- III. Affective/Emotion in Design Education (ADE)
- IV. Design for Smart Environments and Well Living
- V. Emotional Engineering
- VI. Empathetic Design
- VII. Designing Affective and Pleasurable Interactions

Sections I through III of this book cover new approaches in affective and pleasurable design with emphasis on diversity, value creation, cultural and traditional contexts, and ergonomics and human factors. Sections IV through VII focus on environment and design issues in product, service, and system development, human interface, emotional aspect in UX, and methodological issues in design and development. Overall structure of this book is organized to move from special interests in design, design and development issues, to novel approaches for emotional design.

All papers in this book were either reviewed or contributed by the members of editorial board. For this, I would like to appreciate the board members listed below:

- A. Aoussat, France
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This book is the first approach in covering diverse approaches of special areas and including design and development methodological researches and practices in affective and pleasurable design. I hope this book is informative and helpful for the researchers and practitioners in developing more emotional products, services, and systems.

Ottawa, Canada Champaign, USA July 2016 WonJoon Chung Cliff Sungsoo Shin

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# Part I Design of Human Interface and Affective Communication

## Questionnaire Survey Result of the Use of Communication Robots for Recreational Activities at Nursing Homes

#### Teruko Doi, Noriaki Kuwahara and Kazunari Morimoto

**Abstract** We are using information communication technology (ICT) and communication robots (hereafter referred to as "robots") to examine a system to assist recreational activities at nursing homes. The system relies on visual content to deliver a variety of recreational activities, from exercises to reminiscence therapy. Robots support those activities by interacting with nursing home residents. These systems are currently being evaluated at various elderly care facilities, where the prototype has been installed. In this research, we will examine the influence of this service brought to the care staff and nursing home residents based on the result of questionnaire taken from the care staff after the assessment.

Keywords Dementia · Care recreation activity · Communication robot

#### 1 Introduction

Recreational activities at elderly care facilities play an essential role in the maintenance of a quality life. Recreation serves more than the purpose of bringing enjoyment to the residents; it also helps with rehabilitation [1, 2]. On occasion, caregivers get stuck in a rut, and the less experienced staff in particular tends to resist taking the lead in livening things up. With regards to managing recreational activities, one of the issues that need addressing is the training of the young staff [3]. Because of this, nursing facilities frequently end up using DVDs or visual aid in leading exercises, singing and other activities. Although healthy elderly possibly

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© Springer International Publishing Switzerland 2017 W. Chung and C.S. Shin (eds.), *Advances in Affective and Pleasurable Design*, Advances in Intelligent Systems and Computing 483, DOI 10.1007/978-3-319-41661-8\_1 enjoy such visual contents, it is difficult to sustain the focus of elderly dementia patients on visual contents. For these people, we developed a prototype of care home recreational service with a moving robot with active body interconnected with the recreational visual contents, and assessed its effectiveness.

Reports indicate that replacing message boards and other static forms of communication with robots that communicate improve the message's reliability. Other reports have shown that when robots facilitated face-to-face communication between two elderly dementia patients through the TV phone, the subjects were more likely to direct their gaze toward the TV monitor and liven up conversations [4, 5]. The presence of robots with active bodies was therefore expected to increase one's gaze and focus on the visual contents. It is anticipated that the addition of robots opens up the usual staff-to-residents communication to a three-way channel that creates more opportunities for communication between the care staff and the residents. As a result, expectations were that the services currently under examination would reduce stress on caregivers who manage recreational activities, and that will in turn bring about positive changes to the entire program.

Nippon Telegraph and Telephone West Corporation (hereafter referred to as "NTT West") and Nippon Telegraph and Telephone East Corporation (hereafter referred to as "NTT East") are currently examining the recreation system in the aforementioned system using ICT and communication robots. In collaboration with two nursing facilities in the Kansai region and two in the Kanto region, assessment of the expected effect mentioned above was conducted.

In this report, we examined and discussed the influence of this service brought to the care staff and nursing home residents based on the result of questionnaire taken after the assessment.

#### 2 Assessment Method

#### 2.1 System Outline

Figure 1 shows the outline of the system. The hardware used was Hikari BOX<sup>+</sup> [6], a set-top box provided by NTT West Japan, and a robot connected to that. We used FLET'S Hikari [7], an Internet service provided by NTT West Japan and NTT East Japan. Nursing home recreational activities (visual contents) will be available as application of Hikari BOX<sup>+</sup>. Hikari BOX<sup>+</sup> and robots are connected via wireless LAN, and the robot will synchronize its actions with the visual content. The robot Sota [8], as seen in the drawing, will appear only as a torso, 30 cm in height and used on a tabletop.

Hikari BOX<sup>+</sup> is shaped like a box measuring 115 mm  $\times$  105 mm  $\times$  31.5 mm and operated with remote control buttons. The TV is connected through an HDMI cable. The content will vary from children's stories and exercises, to quizzes (calculations, kanji characters), reminiscing (topics from the past), and an introduction to famous local spots.



Fig. 1 System outline

The nursing home recreation system can be activated with the mere press of a remote control button on Hikari BOX<sup>+</sup>. On the other hand, after the remote is used at the time of starting recreation activities or moving on to the next question on a quiz, the robot begins to operate. The robot will then gesticulate and speak words of starting recreations or encouragement.

#### 2.2 Outline of Assessment Schedule

Care staff were given a 2-week pretrial period to become accustomed to the Hikari BOX<sup>+</sup> and learn how to operate the nursing recreation system. At the same time, contents were narrowed down to those that will undergo the assessment. Afterwards, 3 months trial was conducted. During the trial period, a portion of the usual recreational programs carried out at the facilities incorporated Hikari BOX<sup>+</sup> and robot system. Pretrial by NTT West Japan began in mid-June for the Kansai region's assessment, and the 3-month trial began in July. Pretrial by NTT East Japan began in August for the Kanto region's assessment, and the trial was held between August and October.

#### 2.3 Facilities Collaborated with the Assessment

4 facilities in total collaborated with our assessment. In the Kansai Region, Supercourt Co., Ltd., Kyoto Shijo Omiya (privately run nursing home, hereafter referred to as SC) and Telwel Nishi Nihon—Carr Port Osaka Nishi Suita Center (day care, hereafter referred to as CP). In the Kanto region, Social Welfare Corporation Zenkokai—Butterfly Hill Hosoda (special elderly nursing home, hereafter referred to as BH) and Telwel Higashi Nihon—Setagaya Day Service Center (day care, hereafter referred to as SD).

#### 2.4 Assessment Method

#### 2.4.1 Assessment Outline

The assessment included a survey after the 2-week pretrial period that asked the subjects their impressions and opinions of each recreational activity, and the service improvement in response to that. Then, every two weeks during the 3-month trial period of the improved service, that followed, the GBS scale [9] for rating the severity of dementia and its qualitative differences are being used to measure the subjects' emotional function and mental state. Furthermore, on the third month when the nursing staff and the residents have become fully accustomed to the robot and the recreational activities, two evaluations by DCM [10] took place to assess changes in the quality of the facilities' nursing care caused by the incorporation of the new service. When the assessment was concluded, a questionnaire asked the care staff about their impression of using this service or changes among the nursing home residents that they noticed. In this study, we will examine the influence of this service has on the care staff and nursing home residents based on the result of this questionnaire.

#### 2.4.2 About Post-assessment Questionnaire

The questionnaire taken after the assessment was largely consisted of 5 categories listed below. In this study, in order to proceed the discussion based on the results of (1) Changes in the nursing home residents, (2) Influence on the care staff, and (4) The general impression of this assessment, we will list the details of these 3 categories shown in Tables 1 and 2.

- 1. Changes in the nursing home residents (10 questions)
- 2. Influence on the care staff (10 questions)
- 3. Evaluation of the care recreation visual contents (13 questions)
- 4. The general impression of this assessment (4 questions)
- 5. Possibility of adopting this service to private homes (4 questions).

Answering methods for the Tables 1 and 2 are listed.

- \*1 Select from [Agree, Partially agree, Partially disagree, Disagree].
- \*2 Please write freely.
- \*3 Select from [Agree, Partially agree, Partially disagree, Disagree].

1. Chai	Answering method	
Q1	Compare to the usual recreation, the residents participated more actively	*1
Q2	Compare to the usual recreation, the residents started to look forward to having the recreation time more	*1
Q3	Compare to the usual recreation, the residents spoke more frequently during the recreation	*1
Q4	Compare to the usual recreation, the residents had more energetic conversation during the recreation	*1
Q5	The residents showed actions that suggest emotional attachment toward Sota, such as actively talking to Sota	*1
Q6	The residents showed actions that suggest dislike toward Sota, such as their mood turning bad when Sota started to talk	*1
Q7	Compare to before using Sota, the emotional/mental condition of the residents became more stable	*1
Q8	Compare to before using Sota, the health condition of the residents became more stable	*1
Q9	Please write down if there were any other changes than those listed above among the residents	*2
Q10	Do you think the residents were satisfied with the recreation using Sota?	*3

 Table 1
 Detail of questions category 1

#### Table 2 Detail of questions category 2

2. Influ	Answering method	
Q1	Compare to the usual recreation, the time needed for planning/preparing recreation was shorter	*1
Q2	How much time per day did this service help you to shorten?	*4
Q3	Please write down the main reasons why the time did not get shorter	*2
Q4	Compare to the usual recreation, it was easier to implement	*1
Q5	Please specify how exactly did it become easier? * Check all the corresponding points	*5
Q6	Please write down the main reasons why you did not feel it was easier to implement	*2
Q7	Was there anything that felt like reducing the mental burden or supporting you (e.g. healing, sense of security, positive feeling)?	*1
Q8	Please specify exactly in which way did you feel you were receiving mental support? * Check all the corresponding points	*6
Q9	Please write down if there were any other elements than those listed above that helped you in your work	*2
Q10	Aside from Sota, please write down if you have any suggestion for "If there was this kind of product or if you have any problem in your work, it would help my work"	*2

- \*4 Select from More than 30 min, About 15 min, About 5 min, Less than 5 min.
- \*5 Please check the corresponding answers from the list below, or write freely.
  - Recreation required less staff.
  - Introduction and running of recreation became smoother because of the visual contents and/or direction from Sota.
  - It enabled me to work on other duties during the recreation.

What other duties? (Answering telephone. Responding to calls. Writing daily report. Others ()

- It enabled me to support the residents more.
- Others ()

Please write the reasons for "Partially disagree" or "Disagree".

Care facility	Participant	Type of work	Years of experience	Gender	Age
SC	А	Care staff	8 years	Male	In 40s
	В	Care staff	3 years	Female	In 20s
	С	Care staff	1 year and 6 months	Male	In 20s
	D	Care staff	3 years	Female	In 20s
	Е	Care staff	6 months	Female	In 20s
	F	Care staff	3 years and 6 months	Female	In 50s
СР	G	Consultant for everyday affairs	8 years	Female	In 30s
	Н	Care staff	3 years	Female	In 60s
	Ι	Care staff	2 years and 10 months	Female	In 40s
	J	Care staff	1 years and 6 months	Female	In 50s
	К	Care staff	3 months	Male	In 30s
	L	Care staff	3 months	Male	In 50s

Table 3 Participants to the questionnaire

- \*6 Please check the corresponding answers from the list below, or write freely.
  - Appearance/Movement/Speech of Sota was soothing.
  - It enabled me to conduct recreation easily and helped me to focus on other duties.
  - See the residents enjoy made me more positive about my work.
  - Others ()

#### 2.4.3 Participants Answering to the Questionnaire

In this study, we present the result of questionnaire given to the 12 staff members from 2 facilities in Kansai region. Table 3 shows the profiles of the participants.

#### **3** Results of Evaluation from Questionnaire

#### 3.1 Changes Among the Nursing Home Residents

Figure 2 shows the evaluation result of the changes among the nursing home residents. Figure 2 was generated by taking average of 3–0 points given in the 4 choices evaluation of answering methods \*1 and \*3 shown in Sect. 2.4.2.

Questions that received more than 2 points were; Q1: Improvement of motivation in participating in recreation, Q2: Improvement of the attraction of recreation, Q3: Enlivenment of conversation among the residents, Q4: Enlivenment of conversation among residents, Q5: Emotional attachment of residents toward the robot, Q10: Satisfaction of residents for recreation. About these sections, it can be



Fig. 2 Evaluation result of the changes among the nursing home residents

considered that the care staff is generally thinking that this care recreation service had positive influence on the nursing home residents.

Questions that received less than 2 points were; Q7: Stabilization of the emotional/mental condition of the residents, Q8: Stabilization of the health condition of the residents. The effective of this care recreation service was not observed for these sections. Moreover, as Q6 asked if the residents displayed any dislike toward the robot, the answer shows they did not show such dislike.

On the other hand, Q9: Other changes observed among the resident, generated these positive comments listed below.

- 1. The residents grew attached to the robot and started to touch it more each day.
- 2. They started to notice the changes in the movement or eye color of the robot, leading to more diverse conversation.
- 3. The focus of the residents mildly improved.
- 4. They agreed to join the recreation when we mentioned the robot.
- 5. Their bad mood decreased
- 6. They started to smile as though they were looking at a child.

However, there also comments that questioned the effectiveness of the robot, as the residents were focusing on the TV and it was unclear if they understood about the robot.

#### 3.2 Influence on the Care Staff

Figure 3 shows the result of evaluation of the influence on the care staff. Figure 3 was generated by taking average of 3–0 points given in the 4 choices evaluation of answering methods \*1 shown in Sect. 2.4.2. Q1: Compare to the usual recreation, the time needed for planning/preparing recreation was shorter, Q4: Compare to the



Fig. 3 Evaluation result of influence on the care staff

usual recreation, it was easier to implement, and Q7: If it reduced the mental burden or supported you in your work (e.g. healing, sense of security, positive feeling), all received more than average 2 points. This is considered to mean the introduction of this care recreation service has brought the positive influence on the care staff.

For the Question #2: How much time per day did this service help to save your time?, which is a supplementary question of Q1, 8 out of 12 respondents said it helped to save their time more than 30 min.

Moreover, on Q5: Please specify how exactly did it become easier?, which supplements Q4, 12 out of 12 respondents pointed out the necessity of less staff for the recreations. Additionally, both the fact that introduction/conducting recreation became easier and it became possible to engage with other duties were pointed out by 6 respondents. Furthermore, 4 care staff commented that the service enabled them to support the residents during the recreation. Finally, 1 person raised other points.

On Q8: Please specify exactly in which way did you feel you were receiving mental support?, which supplements Q7, 7 out of 12 respondents pointed out that they found the appearance/movement/speech of the robot soothing. Moreover, 6 care staff pointed out that it helped them to focus on other duties as it enabled them to conduct the recreation more easily, and 4 pointed out that it prompted them to engage with the work with more positive feeling as they saw the residents enjoying. Finally, 1 person raised other points.

Regarding Q9: Aspects other than listed above that the usage of the robot helped in work, there were tendency that many care staff said they were able to enjoy the recreation together with the nursing home residents.

Regarding Q10: Please write down suggestion for "it would help my work if there was this kind of product", or if you have any problem in your work, there were various positive requests regarding the care recreation service.

#### 4 Conclusion

In this study, we examined the influence introduction of care recreation service using communication robot to care facilities has on care staff and nursing home residents. This was done according to the result of questionnaire given to the 12 participants (care staff) at 2 care facilities in Kansai region, taken after the assessment. From the result of the questions about the changes among the nursing home residents, it became clear that introduction of this care recreation service encouraged them to join the recreation more actively, increase conversation and engage in more active communication between the residents. On the other hand, it did not show any particular influence on the stability of emotion/mental or health of the residents. However, some of the care staff commented that it decreased bad mood among the residents. Moreover, the DCM evaluation conducted at the last month of assessment showed that statistically, the condition of the residents were significantly better when this service is in use than when it is not [11].

While the care staff observed their familiar nursing home residents daily while they were engaging with care work, DCM evaluation were conducted by external mappers with special qualification. Due to this, there is a possibility that the care staff thought that the subtle changes among the residents during the care recreation was within the margin of error.

Regarding the influence on the care staff, it showed that many staff noticed the shortening of preparation time of recreation and ease in conducting the recreation, and received mental support through the presence of the robot. It must be noted that 2/3 of the respondents answered that they saved more than 30 min. Moreover, as the robot conduct the care recreation, it allowed the care staff to enjoy the recreation with the residents. This can be considered as a factor in the positive influence on the care staff. Additionally, as it was mentioned in the report on DCM evaluation [11], it can be considered that realization of high quality care was enabled through the use of this care recreation, as it allowed the care staff to conduct the recreation with less staff, engage with other duties and support the residents, thus giving them more time and mental space.

We aim to realize further improvement in the service through responding honestly to the many requests given by the care staff toward this service.

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### **Representation of Fundamental Movements and Pauses for Archiving Traditional Skills**

Hiroki Nomiya and Teruhisa Hochin

**Abstract** Considering the reduction of the number of persons engaging in traditional skills, archiving various types of traditional skills is required to preserve and transmit them to future generations. We focus on representing fundamental movements and pauses in traditional skills because they are key components in describing traditional skills and archiving them. The fundamental movements and pauses can be described based on the movements of a number of body parts obtained using motion capture system. In this paper, we propose an efficient method to represent fundamental movements and pauses using the motion data. The proposed method generates concise and informative feature values from the motion data on the basis of dimensionality reduction and feature selection. The effectiveness of the proposed method is evaluated through an experiment to describe several types of fundamental movements in Japanese traditional tea ceremony.

**Keywords** Archiving • Traditional skill • Fundamental movement • Pause • Dimensionality reduction • Feature selection

#### 1 Introduction

There are a wide variety of valuable traditional crafts and industries. It becomes, however, more and more difficult to preserve and transmit them because young people are less interested in traditional cultures and not willing to obtain traditional skills. Moreover, aging of the skilled people makes it more difficult to transmit the traditional skills [1–3]. Therefore, preserving traditional skills is urgently needed.

Most of the traditional skills and industries are founded on various traditional skills. It will be thus effective to archive traditional skills for preserving and

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transmitting them. The archives will be helpful for the people interested in traditional cultures.

In order to archive traditional skills, representing them as a certain type of digital data is important since such type of data can be easily and widely utilized by commonly-used personal computers. For example, video data can be used as an archive. It is relatively easy to make an archive by recording traditional skills using a video camera. However, the amount of video data tends to be very large and thus archiving a wide variety of traditional skills requires a large-scale storage system. In addition, it is difficult for novices to obtain traditional skills by simply watch the video.

In this paper, we propose a method to concisely represent traditional skills using motion capture system. The system captures the movements of several body parts of a skilled person using a number of markers attached on the body parts. The movement is represented by time-series data of the position of each marker. We define some feature values on the basis of the motion data. The amount of raw motion data is very large due to the high sampling frequency of the motion capture system. We intend to fully reduce the amount of data by applying dimensionality reduction to the raw motion data. Additionally, we introduce a feature selection method to further reduce the amount of data and find out the important movement. Our feature values can be defined for each marker. Thus, selected features indicate the important movement of a certain body part. This will be helpful to obtain traditional skills.

We attempt to represent a traditional skill by decomposing it into several fundamental movements because a traditional skill generally consists of several fundamental movements. In this paper, we focus on Japanese traditional tea ceremony as one of the representative traditional skills in Japan. It includes a sequence of fundamental movements. Additionally, a pause, which is called "Ma" in Japanese, is considered to be important as well as the fundamental movements [4]. We conduct an experiment to represent seven types of fundamental movements and the pause in Japanese traditional tea ceremony. The proposed method is evaluated from the viewpoints of the conciseness and accuracy of the representation.

The remaining of this paper is organized as follows. Section 2 presents related work. Section 3 explains the representation of fundamental movements and pauses. Section 4 evaluates the representation through an experiment. Section 5 gives a consideration about the experimental result. Finally, Sect. 6 concludes this paper.

#### 2 Related Work

The movements of traditional skills have been studied to transmit them for future generations. For example, the movements of craft works have been analyzed [1-3]. The pauses in traditional skills have been investigated as well [4]. A learning system has been provided by visualizing the movements of the skills [5]. It is, however, still difficult to precisely represent fundamental movements and pauses of various traditional skills due to their complexity.