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A study on communication generated by virtual reality reminiscence in a psychiatric hospital

Development of a VR reminiscence system and investigation of its potential

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Abstract
It is becoming clear that simulated outings in virtual reality (VR) can help alleviate psychiatric symptoms and improve cognitive function in adult patients and the aged. However, conventional VR simulated experiences using head-mounted displays, which are goggle-type devices, have a major issue in that they can only be experienced by one person and do not allow communication with others. Therefore, in this study, we developed a sharing system for VR simulated experiences that incorporates an element of communication with familiar people and created VR content including memorable places for hospitalized patients. We then investigated how hospitalized patients react when experiencing the content of their own memorable places. As a result, conversations about recalling the past were generated during the experience, indicating that the system and content developed in this study may help prevent dementia and improve the negative symptoms associated with schizophrenia.

Keywords: VR reminiscence, communication, mental health

1 Introduction

1-1 Background

It is estimated that Japan is becoming a super-aging society in which one in every 2.6 Japanese citizens will be age 65 years or older by 2065 [1]. With the expected increase in the number of those in need of nursing care and inpatients in psychiatric hospitals, care prevention and mental health care for the aged is also expected to become increasingly important. Antipsychotic drugs have been used for the treatment and prevention of dementia and psychosis, but they are not effective for all patients, and they are associated with potentially problematic side effects [2]. Therefore, there is a growing need for nondrug therapies that can easily prevent of treat psychosis without the worry of such potential adverse effects.

The average length of stay in a psychiatric bed in Japan is 277.1 days, which is by far the highest compared with other developed countries [3]. Schizophrenia is an illness that makes it difficult to organize one's mind and thoughts, leading to a higher propensity for long-term hospitalization, and accounts for the majority of psychiatric inpatients. Schizophrenia symptoms can be broadly divided into positive and negative symptoms. Typical positive symptoms include hallucinations and delusions, whereas negative symptoms include decreased motivation and emotional expression. The problems that arise from long-term hospitalization for schizophrenia include being cut off from society for an extended period of time, which makes reintegration after discharge from the hospital difficult. This also makes it difficult for the patient to go out because he or she is confined to a room all day. Therefore, it is important to provide nondrug mental health care and help improve quality of life (QOL) in elder care facilities, and especially so in psychiatric hospitals.

1-2 Previous Research and Issues

Several studies have utilized virtual reality (VR) experiences in inpatient and elder care facilities. Niki et al. (2020) reported that VR simulated outings improve patients' psychiatric symptoms without causing serious adverse reactions, and that VR reminiscence methods, which allow patients to experience memorable places, reduce anxiety among the aged in later life[4].

However, one of the issues with VR experiences that use a head-mounted display (HMD) is that such experiences are a solitary experience, during which communication with others is difficult. Reminiscence is a psychotherapy intervention believed to provide psychological care for the aged by allowing them to talk about memories, but the VR reminiscence method, which does not incorporate the essential element of communication, is considered to be less effective [5]. Anders et al. (2021) conducted an experiment involving the co-watching of 360° VR videos in nursing homes. They reported that the VR experience itself led to at least a short-term sense of improved

well-being. However, they also indicated the challenges in terms of holding conversations and creating a sense of shared experience [6]. According to the research, almost all participants expressed paying no attention towards other participants in a room because it is not possible to communicate while understanding the face, facial expression, and body movements of the interaction partner in real time. Furthermore, it is difficult to mutually understand which of the objects in the video the participants are talking about.

1-3 Objective

As shown in these previous studies, sharing memorable places through simulated outings in VR can improve aspects of patients' psychological health and QOL. In particular, we believe that VR reminiscence, a nondrug approach, is very effective for patients undergoing long-term treatment for schizophrenia and other mental disorders. However, to our knowledge, no suitable systems or content for VR reminiscence have yet been developed. Therefore, the aim of the present study is to develop a VR reminiscence system that includes the above communication elements and to verify the effect on the quantity and quality of communication that occurs.

2 Proposed System

2-1 Overview of the VR Shared Viewing System

We proposed a system that allows patients to enjoy memorable VR content while communicating with familiar others such as nurses and family members (Fig. 1). By wearing an HMD, patients (HMD users) living in hospitals and facilities can experience places memorable to them. Simultaneously, families, nurses, and familiar others (PC operators) can experience the 360° VR videos from a PC screen. Images of familiar others are acquired from a camera and displayed in the VR space in the form of a picture-in-picture (PiP), allowing the HMD user to communicate freely with the PC operator. Furthermore, both the HMD user and PC operator can indicate points of interest in the 360° space by using the pointer function.

Fig.1 Overview of the VR shared Viewing System

The HMD used in this study was a Pimax Vision 8K Plus (Pimax Technology, Shanghai, China). This HMD was chosen for the present study because it is known to suppress the "screen door effect," a problem in which a mesh pattern appears on the display. This effect, which has long been considered a problem in 360° VR videos, can be suppressed by increasing the resolution of the display, thereby improving image quality and enhancing the sense of immersion and realism. A comparison between the Pimax Vision 8K Plus and Oculus GO, which has been used in many previous studies, is shown in Table 1.

Table 1 Specification comparison of Pimax Vision 8K Plus

Information	Pimax 8 K Plus	Oculus Go
Resolution	7680×2160	2560×1440
Panel	CLPL Display	LCD
Refresh Rate	110Hz	72 Hz or 60 Hz
MTP Latency	15 ms	-
Cape Vision	Diagonal 200 degrees	100 degrees
IPD	55 mm~75 mm	-
Size	280×108×135 mm	190×115×105 mm
Weight	472 g	468 g

2-2 Development Methods

2-2-1 PiP Communication

Developed using Unity (2020.3.7f1), the PiP displays a real-time video acquired from an external camera in the VR space (Fig. 2). In addition, the position of the PiP can be moved freely by using a controller, so that it does not obstruct the view. To make the system easy to use, even for the aged, it was designed to be as simple as possible: the HMD user only needs to press the trigger and move the controller. During the experience, the HMD user can turn his or her head to experience a 360° field of view; however, because of this, the user may lose sight of the PiP. To prevent this from interfering with communication, the PiP is designed to follow the Y-axis rotation of the head (looking left and right).

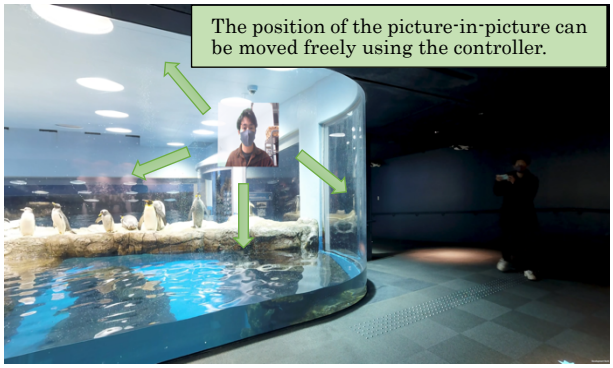

Fig. 2 PiP communication in the VR space

2-2-2 Pointer Function

The HMD user is able to use the pointer function freely in the 360° space by using the controller. A pointer can be generated by pressing the trigger on the controller (Fig. 3). The PC operator can freely look around the screen in 360° by dragging it with a mouse. A yellow pointer appears by right-clicking on the area of interest (Fig. 4). Both pointer effects are shared between the PC operator and HMD user. The pointer uses a

particle effect and disappears immediately after the click. The reason for this specification is that if the pointer is displayed for an extended duration, it cannot respond to moving objects such as the movement of people.

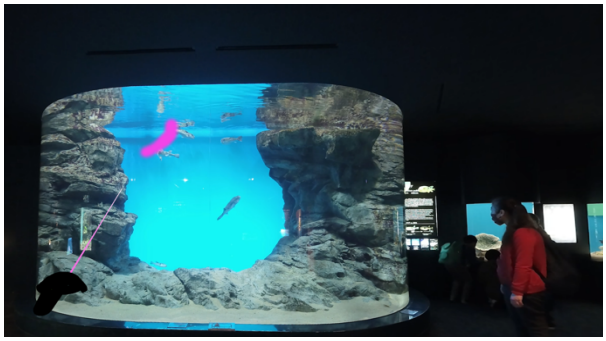

Fig. 3 Pointer function on the HMD side

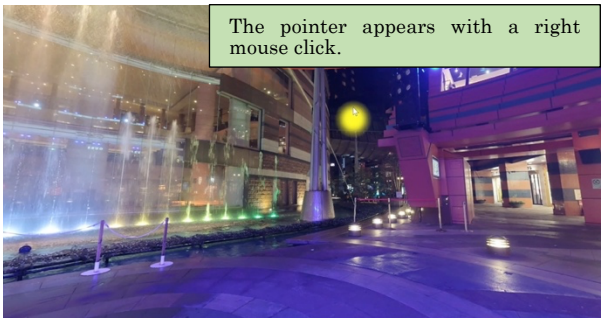

Fig. 4 Pointer function on the PC side

2-2-3 Voice Communication

As a method of voice communication between the HMD user and PC operator, we chose the PUN2 (Photon Unity Networking 2) and Photon Voice2 network libraries (Exit Games, https://www.photonengine.com/), which are used to implement online multiplayer functionality in Unity. One PC was used as the master client, where the user could transition to a 360° VR video by clicking on the title screen of each scene. Scene transitions are synchronized between the two PCs, and the PC on the client side also transitions to the same scene. In this system, two game objects were generated in the VR space, one for the HMD experiencer and the other for the PC operator, using Photon Voice2, and audio picked up from the HMD microphone and the external microphone connected to the PC was played from each object. These game objects are transparent and cannot be visualized.

2-2-4 Content Selection

Clicking on the thumbnail of each VR scene takes you to a video scene involving that location (Fig. 5). The “Connect” button at the bottom of the screen is used to connect on Photon’s game server. By first pressing the “Connect” button, both the HMD user and PC operator are connected to the same lobby, after which, the content can be started.

2-2-5 User Interface (UI) for Content Scenes

The UI on the PC operator’s side is shown in Figure 6. The

Fig.5 Content Selection Screen

“Return to Selection Screen” button returns the user to the selection screen shown in Figure 5 and allows the desired location to be selected again. The “Play & Pause Video” button allows the user to start or pause the 360° VR video, the “Start Camera” button activates the external camera and displays the PC operator’s face in a PiP, and the “Calc” button calculates the percentage of the directional orientation of the viewer (forward/backward/left/right) when pressed after viewing each video. These UIs are not visible to the HMD user, who sees only the controller and the PiP for communication.

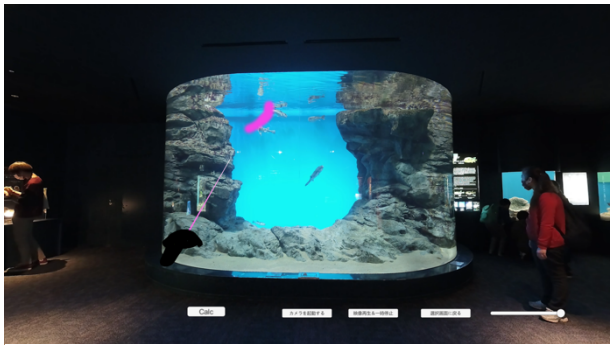

Fig.6 UI in the content scene on the PC side. From left to right: “Calc,” “Start Camera,” “Play & Pause Video,” and “Return to Selection Screen” buttons, 360° VR video volume control bar.

3 Methods

3-1 Hospital and Participants

The cooperating hospital in this study was the General Psychosomatic Hospital “Rainbow and Sea Hospital” in Karatsu City, Saga Prefecture. This 265-bed hospital accepts inpatients from outside the prefecture. Since many patients are under long-term treatment for dementia and schizophrenia, we thought it would be an appropriate facility for the purposes of the present study.

Based on situation surrounding the coronavirus disease 2019 pandemic, one patient (patient Y) was selected with the cooperation of “Rainbow and Sea Hospital.” Patient Y is a 57-year-old woman with schizophrenia who had been hospitalized since October 27, 2010 (about 11 years and 2 months at the time of the study). She can carry out activities of daily life independently and has no positive symptoms such as

hallucinations. However, she is continuously anxious and worried, and as such, remains hospitalized.

3-2 Production of VR Content

We interviewed patient Y about places memorable to her, and based on her responses, created 360° VR videos of the Canal City Fountain Show (Fukuoka, Japan), Ohori Park (Fukuoka, Japan), Niji-no-Matsubara & Kagamiyama in Karatsu (Saga, Japan), and Kaikyokan (Yamaguchi, Japan) for this experiment (Figs. 7–13). The content durations were 3 min 34 s, 2 min 58 s, 3 min 30 s, and 4 min 57 s, respectively. The 360° VR videos were captured using a Insta360 Titan camera, and then compiled and edited using Adobe Premiere Pro (Adobe Inc., San Jose, USA). To maximize image quality, the videos were shot at 11K resolution, exported in 8K resolution using high efficiency video coding (HEVC), and imported into Unity.

Fig.7 Canal City Fountain Show Scene

Fig.8 Underwater Tunnel" Scene at Kaikyokan

Fig.9 Kaikyokan "Penguin Zone" Scene

Fig.10 Ohori Park "Swan Boat" Scene

Fig.11 Ohori Park "Runnning Zone" Scene

Fig.12 Kagamiyama in Karatsu "Shrine" Scene

Fig.13 Kagamiyama in Karatsu "Observatory" Scene

Ohori Park was mentioned by patient Y as a place to which she was deeply attached, and Karatsu was familiar to her because it is near the hospital. As for the Canal City Fountain Show, she has been to Canal City, but has never seen the fountain show there, and as for the Kaikyokan, she has never been there. By including memorable and non-memorable locations, we compared how the patient responded to each content.

3-3 Preliminary Experiment

The preliminary experiment was conducted with 14 "Rainbow and Sea Hospital" nurses during the system and content development phase. Four 360° VR videos were produced: "Canal City Fountain Show," "Shiraito Waterfall (Fukuoka, Japan)," "Ohori Park & Maizuru Park (Fukuoka, Japan)," and "Kaikyokan (Yamaguchi, Japan)." The nurses experienced the system and provided feedback on what kind of VR system and content would be suitable for their patients (Fig. 14). As a result,

Fig.14 A preliminary experiment with 14 nurses examining the usefulness of the content

the following positive feedback was obtained. For example, "It may be suitable for the chronically emotionally blunted," "It is a good way for patients who are not able to get out of the house to experience what it is like to be there." Furthermore, we got some advice to improve this communication system. One is that it would be good if patients could see their own controllers in VR space as well. The second, the operating instructions should be fully explained before wearing the HMD. The third, it would be nice if the volume of the video itself could be adjusted to make it easier to hear the other person's voice. Then, the system and method were improved based on these opinions. Also, we got approval for the ethical aspects of the experiment. In general, we are supposed to conduct an ethics review before human experiment. In the present study, the nurses and hospital staffs who routinely see the patients were asked to judge whether the experiment was appropriate in terms of human right considerations, consent methods, and risks to patients.

3-4 Evaluation of the System from Experts

In the present study, it is difficult to increase the number of participants because this research system is modeled on the method of reminiscence, and it is necessary to prepare content specific to each patient. Therefore, we asked 13 mental healthcare specialists (psychiatrists and counselors) to cooperate with us in order to examine the effectiveness of this system at Yu Mental Clinic (Fukuoka, Japan). The thirteen mental health care specialists were asked to experience a version with and without the PiP and pointing system and compared the ease of communication. The participants chose two of the four 360° videos prepared for the patient Y. First, participants experienced a version without PiP and pointing system, and then experienced the same content with PiP and pointing system. After the experience, the participants were asked to answer the following questions to evaluate the ease of communication. The question1 "Do you think that with the pointer function, compared to without, you will be able to tell the other person about the part of memory or the part you want them to pay attention to?" on a scale of 1 is "Strongly disagree," 5 is "Strongly agree," the question2 "Do you think you will be able to share with your partner the feelings you had during the experience with the PiP (partner's face displayed on the screen) compared to without it?" on a scale of 1 is "Strongly disagree," 5 is "Strongly agree," the question3 "How was the ease of communication with the PiP and pointer function compared to without it?" on a scale of 1 is "It wasn't easy to talk to at all," 5 is "Very easy to talk to, the question4 "How often did you look around at the VR content with PiP and pointer function compared to without it?" on a scale of 1 is "I didn't look around more often at all," 5 is "I looked around very frequently," the question 5 "Please share your thoughts and opinions about this communication system. In this survey, participants were asked to complete the questionnaire based on their hypothetical situation from the perspective of a healthcare professional.

3-5 Implementation Method for the Patient

The study purpose and methods were explained to patient Y and the nurse in charge, and consent for research cooperation was obtained. Then, we explained how to communicate with the PiP and the use of the pointer function. For the experience, the participants were seated, considering the burden on patient Y. Therefore, the "Calc" function, which calculates the user's directional orientation, was not used. The participants experienced the content in the following order: Canal City Fountain Show, Ohori Park, Karatsu, and then Kaikyokan (Fig. 15). The conversations during the experience were recorded. After the experience, a questionnaire about the content was administered.

Fig.15 Patient Y and the nurse during a content scene

The number of times patient Y and the nurse used the pointer function was recorded from the video. As for patient Y, we counted each press and release of the trigger button as one press. As for the nurse, the number of mouse clicks was recorded. In addition, patient Y held the controller with her right hand, but the number of times she gestured with her left hand to point was also recorded. The left-hand gesturing was counted once every time it was removed from where it was placed on the thigh and then placed on the thigh again.

The speaking time of patient Y and the nurse during each content experience was also measured. The recorded voice data were measured by cutting out only the sound source during speech while viewing the waveform using Adobe Audition (Adobe Inc., San Jose, USA). The ratio of their speech time during each content experience was then calculated.

4 Results

4-1 Evaluation Results from the Experts

The thirteen mental health care specialists were asked to experience a version with and without the PiP and pointing system. Then, they compared the ease of communication of the systems. The results of the evaluation are shown in Figure 16. For question 1, more than 84.6% of the participants answered “Agree a little” or “Strongly agree. For question 2, 100% of the participants answered “Agree a little” or “Strongly agree. For question 3, more than 92.3% of the participants indicated that they felt ease of communication somewhat or very much. For question 4, more than 84.6% of the participants indicated that they looked around somewhat more often or they looked around very much more often. These results confirmed that this system was very effective in terms of sharing experiences and facilitating communication. We also found that the PiP and pointer function increased the frequency of looking around at 360° VR content. This indicates that the pointer function allows for the effective use of 360° content. Then, the following positive feedback was obtained in the question 5. “It is easy to see what the partner are looking at,” “I was very impressed,” “I was happy to share this experience with the partner (PC operator). I had a greater sense of sharing when we could talk about what we shared,” “I enjoyed it because I could empathize with my partner. On the other hand, the following feedback was obtained to further improve the system. “I thought it would be a little difficult to get used to using the pointer function,” “I felt the HMD was a bit heavy,” “For some elderly or patients, wearing an HMD may be stressful,” “It would be nice to see the other person’s face more clearly.” Considering the above feedback, it was suggested that this system was effective in terms of sharing experiences with others, however, has challenges in operability and comfort.

4-2 Questionnaire Results from the Patient

The results of the content evaluation questionnaire are shown in Table 2. VR sickness is often cited as a challenge in VR experiences, but the VR content produced in this study was found to be enjoyable without worsening the participant’s physical condition or mood. In addition, we were particular about image quality during the production process, and as a result, we obtained feedback that the image quality was “very good.” As for the operation of the controller, which had been a concern, the patient responded that it was “very intuitive.” Regarding the length of the videos, all content was described as being “just the right length,” except for Ohori Park, which as was described as “somewhat short.” Regarding the level of satisfaction with the content, the participant responded that she was “very satisfied.” As for the most impressive content, she indicated that all of the content was impressive. As for the reasons why she was impressed, it turned out that she was surprised by the initial experience but enjoyed the realism. In an oral interview after the questionnaire survey, the patient said that “Illumination” and “Ohori Park” were particularly impressive. However, she could not think of any answer to the question “What kind of content would you like to experience and with whom?” Finally, as her overall impression of the VR content produced in this study, the patient said, “I think I will never forget today’s experience.”

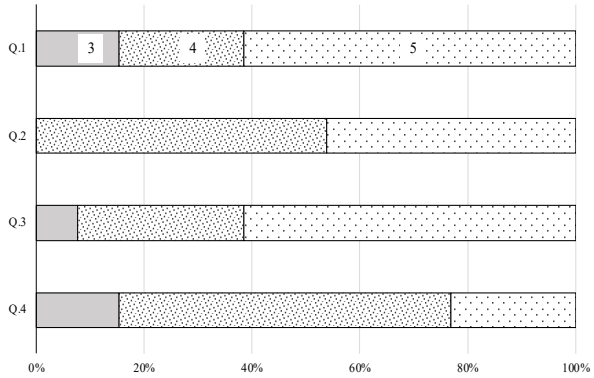

Fig.16 The evaluation of the system with 13 mental health care specialists. They answered the following questions on a scale of 1 to 5. Question1 “Do you think that with the pointer function, campared to without it, you will be able to tell the other person about the part of memory or the part you want them to pay attention to?” Question2 “Do you think you will be able to share with your partner the feelings you had during the experience with the PiP campared to without it?” Question3 “How was the ease of communication with the PiP and pointer function campared to without it?” Question4 “How often did you look around at the VR content with PiP and pointer function campared to without it?”

4-3 Observed Conversations

The conversations generated by the experience of the Canal City Fountain Show can be categorized into three main types. The first is about memories. Patient Y stated that although she had been to Canal City Hakata, which is located in Fukuoka city, she had never seen the Christmas Fountain show. The nurse asked, “When did you go there?” and she replied, “When I worked decades ago” (When she was still working in fer life). When the nurse followed up and asked, “Have there been any changes in the appearance of the location, etc., since then?”, the patient said that she had not seen the fountain show, and there

Table 2 Results of the Content Evaluation Questionnaire

Questions	Answers
1. Was this your first VR experience?	Yes
2. Did you have any VR sickness?	I had no VR sickness at all.
3. How did you feel about the image quality?	Very good
4. Did you understand the operation of the controller?	Very understandable
5. What was the length of each piece of content?	Canal City Fountain Show →Just the right length
	Ohori Park →Somewhat short
	Karatsu →Just the right length
	Kaikyokan →Just the right length
6. What is your level of satisfaction with each content?	Canal City Fountain Show →Very satisfied
	Ohori Park →Very satisfied
	Karatsu →Very satisfied
	Kaikyokan →Very satisfied
7.Which content impressed you the most?	Canal City Fountain Show, Ohori Park, Karatsu, Kaikyokan
8. What are your reasons for being impressed?	It was my first experience, and I was able to experience the place as if I had been there.
9. With whom would you like to experience what kind of content?	No filled in
10. Is there anything you would like to see improved?	There is nothing in particular that I would like to see improved.
11. Please feel free to write your thoughts at the end.	I will never forget today's experience. Thank you very much.

had been no change in the appearance of the building. The second category consists of a conversation about impressions and surprises. The content of the fountain show consisted of fast-paced music accompanying a powerful and beautiful fountain show. Conversations arose in which patient Y shared her impressions of the experience, such as "awesome," "beautiful," "fun," and "I've never seen anything like this before," with the nurse. The third type is a conversation in which the patient described the music she heard and the objects she saw, such as "there is some music playing," "It's slow now," or "It's kind of intense now."

Conversations that emerged from the Ohori Park experience can be divided into two main types. From the conversations that emerged during the experience, we learned that patient Y used to live near Ohori Park and often took walks there on her days off. She recalled past experiences and memories, making remarks such as, "I used to walk all the way around," and when she saw people running, she said, "there were a lot of people running like this." In particular, she had a strong memory regarding swan boats, and a conversation was recorded in which she sought out a swan boat and shared it with the nurse, pointing to it with the pointer and saying, "Here, here, there was a ride." She also made the remark, "Oh no, I kind of miss it." The second type touches on the background of patient Y's habitual behavior. Regarding the fact that she often took walks in Ohori Park, the nurse said, "So you have been taking walks for a long time." This indicates that frequently taking a walk was a habit of patient Y's from long ago.

Karatsu is located in the vicinity of the hospital and is a familiar place visited on a regular basis by patient Y. Two main types of conversations emerged from the experience of this content. The first is about memories. The previous year, patient Y visited Kagamiyama in Karatsu as part of her occupational therapy (OT) program, and conversations about that activity were generated. For example, in the Kagamiyama shrine scene, the nurse asked, "Did you draw a fortune during that OT?", to which, the patient answered, "Oh, yes, I did! It was a daikichi (great luck) fortune!" The second type is a conversation describing the object being viewed. In the scene from the Kagamiyama observation deck, the patient used the pointer function and asked, "Where is the Aeon?" and "Well, um, if you go all the way over there, where's Mr. Max?" Conversations were then generated to search for and share information about the shopping malls they knew.

The Kaikyokan is the only place patient Y had never been. There were two main types of conversations that emerged from this experience. The one that made up the majority of the conversations was communication about the objects in the images. For example, regarding the fish swimming in the tank, patient Y asked, "What kind of shark is it?" and "What is this fish?" The conversation generated questions about unknown objects and descriptions of the objects they were viewing, as well as statements describing the behavior of penguins. The second type of conversation involved sharing emotions such as excitement and surprise. For example, for the "Underwater

Tunnel" scene at Kaikyokan, conversations emerged in which the patient expressed surprise at seeing a large school of sardines and shared her feelings of empathy for the cuteness of the finless porpoise and ray. Numerous comments were also made about the sense of realism overall. In Ohori Park, the comment "It really feels like we are here" was recorded twice, and in Karatsu, the comment "It feels like we are here" was recorded five times. In the Kagamiyama scene, the comment "It feels like I could jump off from here" was made, and in the ocean scene, the comment "It feels like there is sand" was made, indicating that the experience was perceived to be highly realistic.

4-4 Percentage of Speaking Time

The percentage of time spent speaking during each scene was calculated as follows. Patient Y and the nurse spoke during 23.3% and 26.2% of the Canal City Fountain Show, 37.2% and 24.2% of Ohori Park, 33.3% and 29.8% of Karatsu, and 27.4% and 33.0% of Kaikyokan, respectively (Fig. 17). It should be noted that although this system has a function allowing for pausing of the video, it was never used in this experience.

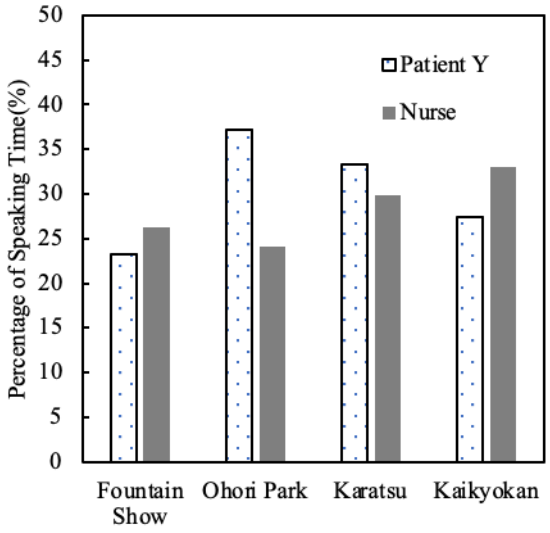

Fig.17 Percentage of speaking time during each experience for patient Y and the nurse

Regarding the percentage of time occupied by patient Y's speech, Ohori Park was the longest, followed by Karatsu, Kaikyokan, and the Canal City Fountain Show. In contrast, the nurse spoke the most during Kaikyokan, followed by Karatsu, the Canal City Fountain Show, and then Ohori Park.

4-5 Pointer Function

The number of times patient Y used the pointer function was none for the Canal City Fountain Show, one for Ohori Park, four for Karatsu, and six for Kaikyokan. When the number of pointing gestures by the left hand without using the controller was measured, the frequency was once for the Canal City Fountain Show, eight times for Ohori Park, three times for Karatsu, and once for Kaikyokan (Fig. 18). The number of times the nurse used the pointer function was twice for the Canal City Fountain Show, once for Ohori Park, 10 times for Karatsu, and once for Kaikyokan (Fig. 19).

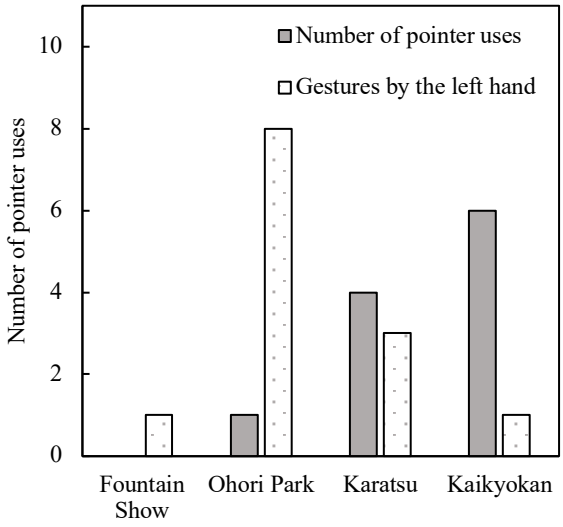

Fig.18 Number of pointers uses by patient Y and number of pointing gestures with her left hand

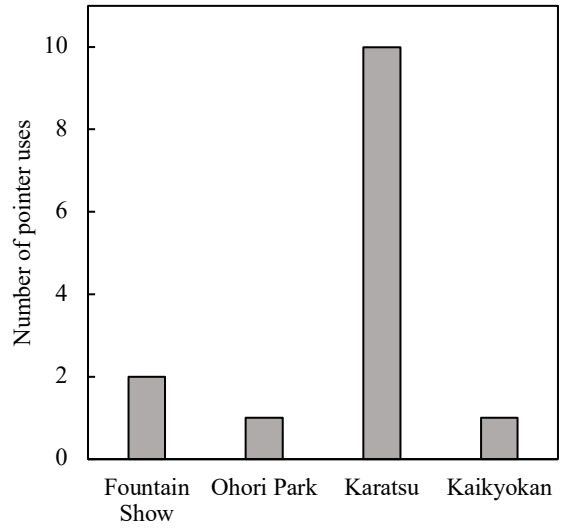

Fig.19 Number of pointers uses by the nurse

5 Discussion

5-1 Observed Conversations

By experiencing VR content associated with places patients remember and have been to in the past, and sharing these experiences with a familiar nurse, communication involving reminiscence about the past was generated. Hosokawa et al. (2016) suggested that looking back on life through reminiscence improves cognitive function [7], and thus, the system and associated content described in the present study are expected to activate the brain and prevent cognitive decline. In addition, as Gibb et al. (1997) stated, recounting memories to others through reminiscence has the effect of enriching self-realization and enabling connection with the next generation,

not only for older adults with dementia, but also for healthy older adults [8]. Gibson (1994) stated that reminiscence itself is significant in that it is an enjoyable experience and a pleasant activity [9]. In addition to the fact that the VR experience in the present study enabled the patient to experience a memorable place while she was in the hospital, we believe that sharing this experience with the nurse, who was close to the patient, and communicating with her, had a positive effect on the psychological health of the patient.

Similar to patient Y, there are many cases involving patients with schizophrenia who do not have positive symptoms but are forced to be hospitalized because of negative symptoms. Okada et al. (2020) stated that negative symptoms are an important factor related to social functioning and a disincentive to discharge in long-term hospitalized schizophrenic patients [10]. Negative symptoms include anhedonia (i.e., a decreased ability to experience or anticipate pleasure, and a loss of interest or pleasure) and asociality (i.e., decreased interest in forming close relationships with others), avolition (i.e., decreased initiation and persistence of goal-directed behaviors, including social participation and self-care, such as in work and school), blunted affect (i.e., decreased nonverbal expression of emotions, including facial and vocal inflection, and gestural phenomena), and language poverty (i.e., decreased speech volume).

The present VR experience generated conversations about shared emotions and was considered by the patient to be highly realistic. Increased interest and experience of pleasure can be expected to help prevent anhedonia. We also believe that communicating and forming close relationships with familiar others can help prevent asociality, loneliness, and language poverty. Furthermore, some of the responses observed in the present VR experience included statements and gestures expressing emotions, the elicitation of which may lead to the prevention of blunted affect.

In nursing, it is said to be important to recognize that older adults are individuals with diverse backgrounds and to respect their individuality and values [11]. In the present VR experience, patient Y revealed a past in which she often took walks when she lived near Ohori Park. She also revealed a memory of a visit to Kagamiyama Shrine in Karatsu during an OT activity, where she drew a fortune and got a “great luck” fortune. We believe that this will lead to a better understanding of the patient’s background on the part of the medical staff and family members, and thereby to better treatment, nursing, and therapy.

5-2 Percentage of Speaking Time

The percentage of time occupied by the speech (percentage of speaking time) of patient Y and the nurse was calculated for each video. As for patient Y, the highest percentage of speaking time was for Ohori Park, followed by Karatsu and the Canal City Fountain Show. In contrast, the nurse’s percentages were largest for Kaikyokan, followed by Karatsu, the Canal City Fountain Show, and Ohori Park. This indicated that Ohori Park was the one of memorable places for the patient, therefore, she tended to talk about herself more often. As for Kaikyokan, the reasons for this discrepancy may be that Kaikyokan was the only place to which patient Y had never been, and therefore, the nurse was proactive in broaching the topic. As for the Canal City Fountain Show, the main focus was on viewing the show, so there may have been fewer opportunities for both parties to communicate. As for Karatsu, both participants had a high percentage of speech. The reasons for this may be that they had common topics such as the OT activities, and the view from the observation deck prompted communication by allowing them to point out locations to one another. Although definitive conclusions cannot be drawn because there was only one subject, the findings suggest that the content of memories can elicit conversations among experiencers themselves, and that a common topic of conversation between subjects can stimulate interactive communication.

5-3 Pointer Function

Based on the results of the questionnaire, it appears that the use of the controller was “very intuitive.” In addition, when referring to the number of times the pointer was used, as shown in Figure 18, the number of times was higher for the content experienced toward the end (none for the Canal City Fountain Show, once for Ohori Park, four times for Karatsu, and six times for Kaikyokan). The following two reasons can be considered to explain the differences in the frequency of use for each video.

The first is that they may have become accustomed to operating the controller over time. When we measured the number of pointing gestures made by the left hand not holding the controller, the results were: one for the Canal City Fountain Show, eight for Ohori Park, three for Karatsu, and one for Kaikyokan. The number of gestures for the Canal City Fountain Show was considered to be significantly low because there were almost no objects to point to. For the other content, the usual body movements like left hand gestures came out naturally at the beginning of the experience, but as patient Y became accustomed to using the controller, she was able to use the pointer function more actively. Second, the content differed. In the Kaikyokan experience, many of the conversations were about the fish swimming in the tanks, and the context may thus have necessitated the gestural identification of the topic of conversation; this provided many opportunities to use the pointer function. Similarly, for the Karatsu experience, it was necessary to share the objects the patient and nurse were looking at, especially when viewing the scenery from the observation deck, such as the location of the shopping mall. These considerations may explain the frequent use of the pointer function in these latter scenarios.

5-4 Impressive Content

All content was considered by the patient to be impressive based on the results of the questionnaire. However, in the post-questionnaire interviews, the Canal City Fountain Show and Ohori Park were considered particularly good. As for the Canal City Fountain Show, it was the most well-received content in the preliminary experiment targeting staff members and found to be enjoyable for all visitors. On the other hand, the reason why Ohori Park was mentioned could be because it was a place

with deep memories; patient Y had lived in Ohori Park for several years and used to take a walk there on her days off. Memorable places appear to be very effective content for shared VR viewing experiences with familiar others.

6 Conclusion

In this study, we developed a VR shared viewing system that incorporates elements of communication with familiar others to investigate what kinds of reactions and conversations are generated when hospitalized patients experience VR content of their own memorable places. As a result, in addition to the sense of presence and immersion that only VR can provide, conversations about memories, the sharing of impressions and surprises, and descriptions of the object being viewed were generated. The results also suggested that the more deeply one is attached to the content, the more one tends to reminisce about the past and share it with others. Therefore, the system and content developed in this study show potential as a nondrug therapy for preventing dementia and improving the negative symptoms of schizophrenia.

7 Future Challenges and Prospects

In this study, the sample size was small (only one patient) due to the need for patient-specific content, so the quantitative evaluation regarding the psychological effects was not sufficient. However, the results suggest that experiencing a memorable place in VR with a familiar other and communicating with that person by sharing that experience may be a very enjoyable experience for the patient. In the future, we would like to increase the number of participants and discuss further the usefulness of this experience based on quantitative evaluations of its psychological effects.

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