Remote virtual counseling and effects of embodied cues: toward casual on-line counseling under COVID-19 situation

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Abstract. Some embodied cognition literature has shown that some environmental factors contribute to reducing client protective attitude. We have applied this aspect to counseling in VR. The aims of this paper are (1) to confirm VR environmental factors affect the subject's sense of openness, (2) explore the relationship between self-disclosure attitudes and environmental factors, and (3) investigating remote and semi-automatic counseling possibilities in this COVID-19 affected stressed world via virtual psychological experiment. We proposed the hypothesis: the large room would promote self-disclosure to a NPC virtual counselor more than the small room. We have made a "VRChat" based counseling rooms with the NPC virtual counselor. On self-disclosure attitude, the results of the Mann-Whitney U test showed that the large room promotes self-disclosure more than in the small room ($U = 216, p = .01, d = -.657$). These results suggest the potential for a remote and easy-to-participate virtual environment for casual counseling.

Keywords: embodied cognition · human-computer interaction · self-disclosure virtual counseling · virtual reality counseling · room size · NPC counselor

1   Introduction

Embodied cognition is one of the emerging theories in many areas of psychology. The concept implies that the environment influences our perception and behavior unconsciously or preconsciously. Theories of embodied cognition share the idea that cognitive representations and operations are fundamentally grounded in their physical context [1]. In a study of embodied cognition, Dawson *et al*. [2] presented subjects

with a rather social dilemma task. They then conducted interviews in an open room (e.g., a large room with a picture of the sky and the sea) and a small room (e.g., a small room with two hard chairs). The results showed that people in the open room tended to be more likely to disclose information than those in the small room.

We consider the embodied cognition to be able to apply to clinical psychology methodologies, such as counseling. Based on [2], the expansion of the physical room may facilitate self-disclosure of the client. The psychologist grasps the client through psychological assessment, and therefore, there is more self-disclosure from the client. Being able to change the room size based on their preferences and symptoms would be ideal. Although modifying a real room is difficult, it is rather doable in virtual reality (VR) environments.

Social VR space such as VRChat [3], where people can communicate with other people without worrying about time or place, is expected to allow many people to visit the room quickly. Under difficult COVID-19 situations, restricted movements and increasing stress have increased the necessity of counseling in a VR space. There is a counseling technique that asks participants to make their problem list. Then, a participant himself/herself would answer the problem. That is a kind of self-objectification. When answering one's questions in a VR counseling situation, the facilitation of objectification is noticeable by switching from one's avatar to a Freuds avatar, and then it helps subsequent attitude changes and self-awareness [4].

In this pandemic period, where there is restricted mobility, in stressed situations, in after natural disasters, there are huge losses of life and detriments of social values; more counseling is required. It is not realistic to have a psychologist logged in and served 24 hours a day on VR space to provide counseling. Also, users may feel uncomfortable when they had counseling by a stranger. Pickard *et al*. [5] have shown that an embodied conversational agent tends to be more self-disclose than a human interviewer concerning sensitive information. In addition, Lucas *et al*. [6] have indicated that the subject's willingness to self-disclose increases when they perceive the virtual humans are controlled by a computer. Thus, if people can feel free to consult with the Non-Player Character (NPC) in a virtual counseling room designed to promote self-disclosure, their mental health will improve. Okken *et al*. [7] presented four pictures of different room sizes and interpersonal distances to examine the relationship between the room environment and self-disclosure. The results showed that self-disclosure was enhanced in larger rooms and at greater interpersonal distances. In a subsequent study, self-disclosure further examined by varying the physical room size and the interpersonal distance, and significant results were obtained [8]. Based on [2], [7], and [8], it concluded that "Room Size" might affect self-disclosure even in VR space. The aims of this paper are as follows.

(1) To confirm VR environmental factors affect the subject's sense of openness.
(2) Explore the relationship between self-disclosure attitudes and environmental factors.
(3) Investigating remote and semi-automatic counseling possibilities in this COVID-19 affected stressed world via virtual psychological experiment.

We proposed the hypothesis: the large room would promote self-disclosure to the NPC virtual counselor more than the small room.

2 Experimental method

2.1 Participants

Fifty-four students and graduate students at Hiroshima International University participated in the experiment (twenty-four males and thirty females). All participants had no color vision abnormalities. Ten participants had already experienced VR.

2.2 Experimental environment

The experimental program was made with Unity (2018.4.20f1). The Virtual Counselor (VC) and subject's avatar were created using VRoid Studio (v0.8.3). The subject PC was CyberpowerPC Gamer XtremeVR desktop (OS: Windows10 Pro 64bit, Intel i5-6402P, Radeon (TM) RX 480 4GB Graphics). The HMD (Windows MR) was used only by the subject. The VR controller was a standard Windows MR controller.

2.3 Experimental condition

There were two conditions, the large room (Figure. 1) and the small room (Figure. 2).
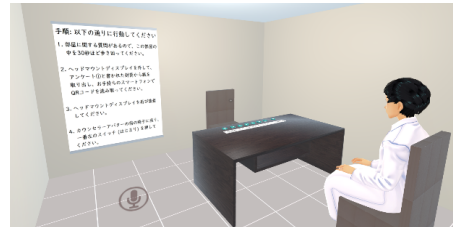

Fig. 1 The large room in VRChat   Fig. 2 The small room in VRChat

In Figure 1 and Figure 2, We took care to control the object's size and position (e.g., the distance between the desk and the chair) and the brightness, except for the difference in the size of the rooms. As shown in Figure 3, the waiting room is set up as the first place for the subjects to enter. We created all the rooms in one VRChat world. The large room is 7 (length) ×7 (width) ×4 (height). The small room is 3.5 (length) ×3.5 (width) ×2 (height). The waiting room is 5 (length) ×5 (width) ×3 (height).

In general, it is welcomed in VR psychology that avatars are associated with a sense of body ownership (e.g., avatars created by 3D scanning the personal image increase the sense of body ownership [9]). However, changing the avatars for each gender of the subjects caused the proteus effect [10] individually, which could have been an extraneous variable in this experiment. Therefore, we controlled for one avatar for each subject (Fig. 4). We have created one VC to evoke a doctor or a psychologist in the hospital.

Fig. 3 The waiting room in VRChat

Fig. 4 VC and Subject's avatar

2.4 Materials and procedure

Perceived Spaciousness, Intended Self-Disclosure, Neuroticism, and Extraversion, were used as survey items. Each scale was presented using a Google Form. In every question, respondents were to answer by 7-point scale (completely no feeling = 1; to very feeling = 7) or by 5-point scale (strongly disagree = 1; strongly agree = 5).

Perceived Spaciousness: It is translated [7] questions (4items) into Japanese. Cronbach's α was .96 (Experiment 1) and .79 (Experiment 2) in [7]. Each of the questions responded by a 7-point scale.

Intended Self-Disclosure: It is translated [7] questions (4items) into Japanese. Cronbach's α was .92 (Experiment 1) and .87 (Experiment 2) in [7]. Each of the questions responded by a 7-point scale.

Extraversion: To examine the effect of personality, we used the first factor of the Big Five scale by Namikawa *et al*. [11], Extraversion (Cronbach's α = .86; 5 items). Each of the questions responded by a 5-point scale.

Neuroticism: To examine the effect of personality, we used the third factor of the Big Five scale by Namikawa *et al*. [11], Neuroticism (Cronbach's α = .82; 5 items). Each of the questions responded by a 5-point scale.

Qualitative evaluation of questions about the depth of self-disclosure: We refer to the development research of the scale which measures the depth of the self-disclosure [12], the question items came to be. The contents of the questions are in Table 1 below.

Table. 1 Questions about the depth of self-disclosure

Level of explanation on Hobbies	What is your favorite food? / What was fun recently?
Level of explanation on difficult experiences	How do you release your stress? / What has helped you in a difficult situation?
Level of explanation on foibles	What are some of your own minor foibles in your daily life?

All the experiments were conducted remotely via VRChat. Therefore, the time spent between the experimenter and the subject was about 10 to 15 minutes. Due to the COVID-19 situation, there was minimal physical contact. After obtaining the subject's consent for the experiment, the experimenters sat them down on chairs and asked them to log in to VRChat. At that time, the experimenter moved to another room and taught the operation procedure via VRChat. The flowchart of the process is

in Figure 5. All subjects had the experience of answering questions from the VC only once. The Virtual Counselor was programmed to start with a self-introduction to alleviate the anxiousness and nerves of the subject. Then, proceeding to ask the routine questions in Table 1. The subjects were able to get going with the conversation at their timing. The perspective of the large room and the small room from the subjects are in Figure 6 and Figure 7.

The subjects responded to the Virtual Counselor's questions by speaking. We have randomly assigned them to either the large or small condition in the room.
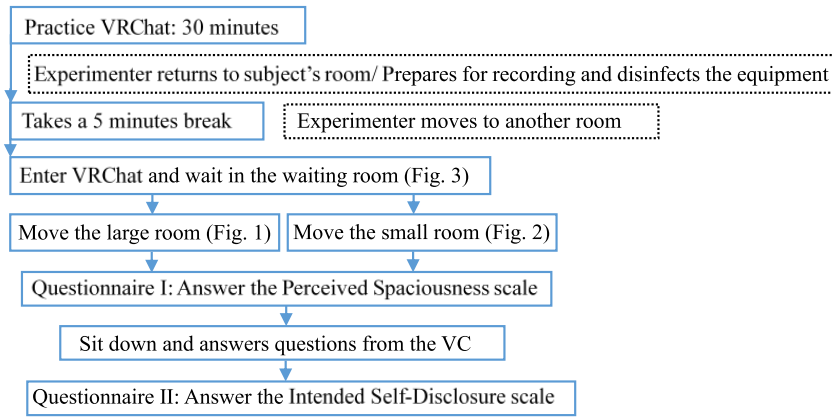

Fig. 5 Flowchart that subjects experience in experiments

Fig. 6 Face the VC in large room   Fig. 7 Face the VC in small room

3   Results

Each variable summarizes up to an additional value. The equation is shown below.

$$QuestionCategorySum = \sum_{i=1}^{4} X_i$$

Descriptive statistics, reliability factors (Cronbach's α), and Shapiro-Wilk's p for each additional value are shown in Table 2.

Table. 2 Descriptive statistics, Cronbach's alpha, and Shapiro-Wilk test

	Mean	SD	A	Shapiro-Wilk's p
Perceived Spaciousness	18.1	4.81	.77	.091
Intended Self-Disclosure	17.5	6.06	.84	.084
Neuroticism	18.9	4.05	.80	.003
Extraversion	16.9	3.99	.79	.033

The Cronbach's α has an appropriate value. Therefore, the questions in one category for the rooms of both groups were generally about similar contents. A Q-Q plot of each additional value was constructed to examine the normality of the residuals. As a result, the Q-Q plot was not linear. Also, we created a histogram and conducted the Shapiro-Wilk test. As a result, significant differences were found in Neuroticism and Extraversion (Table. 2). Also, the results of the Shapiro-Wilk test for each item of Perceived Spaciousness and Intended Self-Disclosure showed significant differences for all items. Therefore, it seemed appropriate to use a non-parametric test in this study. The Mann-Whitney U test commenced with the size of the room as the independent variable and the perceived spaciousness as the dependent variable ($U = 144, p < .001, d = -1.23$). This test examined the appropriateness of the perceived size of the room for both groups. To further investigate the results in more detail, that analysis interpreted with room size as the independent variable and each item of the perceived openness scale as the dependent variable. The results are in Table 3.

Table. 3 U-test for each item of room size and Perceived Spaciousness

Items	Mann-Whitney U test
1. **I would feel constricted in this room** (R)	$U = 203, p = .004, d = -.852$
2. **I would feel confined in this room** (R)	$U = 117, p < .001, d = -1.49$
3. **I would have sufficient freedom of movement in this room**	$U = 237, p = .024, d = -.654$
4. **I would easily feel suffocated in this room** (R)	$U = 249, p = .039, d = -.604$
(R) 1, 2, and 4 are reverse items.	

From Table 3, the room differences affect the subject's sense of openness. Mann-Whitney U test commenced with room size as the independent variable and intention to self-disclose as the dependent variable ($U = 216, p = .01, d = -.657$). To further examine the results in more detail, a similar analysis had conducted with room size as the independent variable and each item of the intention to self-disclose scale as the dependent variable. The results are in Table 4.

Table. 4 U-test for each item of room size and Intended Self-Disclosure

Items	Mann-Whitney U test
1. **would feel inhibited from speaking in this room** (R)	$U = 237, p = .024, d = -.64$
2. In this room I would feel able to speak freely	$U = 295, p = .222, d = -.293$
3. I would feel uncomfortable to share personal information in this room (R)	$U = 269, p = .091, d = -.47$
4. **It would be hard for me to talk about myself in this room** (R)	$U = 221, p = .011, d = -.721$
(R) 1, 3, and 4 are reverse items	

Table 4 has shown that the hypothesis that the large room would promote self-disclosure to the NPC virtual counselor more than the small room, was supported. On the other hand, other independent variables have significant effects on Neuroticism ($U = 338, p = .645$) and Extraversion ($U = 354, p = .855$).

Concerning individual speech, subjects with a low amount of speech are present regardless of whether the room was large or small. These subjects only responded to the Virtual Counselor questions with a single sentence. The subjects with a large amount of speech are in both rooms, and they answered the Virtual Counselor questions from several events or talked about one thing for a long time. Some of the subjects talked about sensitive topics such as the following:

・I quit school

・I stopped going to school

・I got admitted to a hospital for an illness

・Someone close to me died

This kind of topic indicates a deep level of self-disclosure.

4 Discussion

The purpose of this study was (1) To confirm VR environmental factors affect the subject's sense of openness. As shown in table 3, the virtual room size affects the subject's sense of openness. (2) Explore the relationship between self-disclosure attitudes and environmental factors. The results of the *U*-test showed that there was a significant relationship between room size and intention to self-disclose. (3) Investigating remote and semi-automatic counseling possibilities in this COVID-19 affected stressed world via virtual psychological experiment. We have experimented remotely on VRChat and unexpectedly found a deep level of self-disclosure. The results of the remote experiment on VRChat showed an unexpectedly deep level of self-disclosure, suggesting the possibility of casual counseling in VR. The results in Table 4 showed that self-disclosure was facilitated by the effect of embodied cognition for subjects in the large room, while self-disclosure was suppressed by the pressure and smallness of the room for subjects in the small room. Therefore, it is essential to adjust the environment.

Based on the above, we can expect to create a system in which a pseudo-counseling room is created in an actual psychological clinical situation, and Virtual Counselor listen to consultations. In such a case, since the effect of promoting self-disclosure has been confirmed in a large room, the size of the room should be larger than the waiting room (5 (length) × 5 (width) × 3 (height)). It is expected that the NPC virtual counselor will collect the assessment information in the future.

In this study, we planned to conduct the experiment remotely in order to make the most of the characteristics of VR. It is rare in the world to conduct a VR psychology experiment via VRChat with university students who have never used it before. Besides, the outcome of this study shows that even in a world where infectious diseases are widespread, it is possible to conduct remote experiments via VR while taking infection prevention measures.

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