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Promoting Pro-Environmental Behavior through Destructive Experiences in Virtual Reality: Design and Implementation of the VR Experience

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ABSTRACT

Promoting pro-environmental behavior (PEB) requires not only awareness but also emotional engagement. This study proposes a novel virtual reality (VR) destruction task designed to evoke positive emotions such as exhilaration and a sense of accomplishment to promote PEB. In the task, participants answered simple environmental quizzes by breaking panels in a VR environment using a handheld stick. A preliminary experiment with ten participants who were divided evenly into a test and a control group demonstrated that the test group exhibited a 1.2-point increase on the PEBT compared to a –0.2-point change in the control group. These results suggest that enjoyable, active experiences in VR can promote PEB through positive emotional activation. Future studies with larger sample sizes will be conducted to verify the statistical significance of these findings and enhance the validity of this emotion-driven behavioral approach.

Keywords: Positive emotions, Active pleasure, Destruction

INTRODUCTION

In recent years, environmental and energy issues have become increasingly serious. To address and mitigate these challenges, promoting individuals' pro-environmental behavior (PEB) has become crucial. PEB includes actions such as saving electricity, conserving water, and sorting waste; however, it remains a challenge to translate awareness into actual behavior. Therefore, additional motivational strategies beyond mere awareness are required to encourage PEB.

Although numerous studies have examined PEB, a high level of concern about environmental issues does not necessarily lead to the actual implementation of PEB (Bamberg, 2007). This finding suggests that enhancing awareness and concern alone is insufficient, and other forms of intervention are needed. Recent studies have highlighted the critical role of psychological states in PEB, particularly the induction of positive emotions, which has been highlighted as a key factor influencing behavioral engagement.

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For example, presenting environmental messages designed to evoke positive emotions increased participants' intentions to engage in PEB (Chatelain, 2018). Similarly, in a donation game, positive emotions tended to increase the amount donated to environmental organizations, suggesting that emotional states can influence voluntary pro-environmental actions (Ibanez, 2017). These findings imply that positive emotions serve as a psychological mechanism not only for enhancing awareness but also for facilitating sustainable behavioral change.

The aim of this study is to design and implement a positively framed destruction experience in virtual reality through a preliminary experiment, in order to explore its potential to evoke positive emotions and consequently promote pro-environmental behavior. This paper reports on the design of the VR destruction task and presents preliminary experimental results examining its effects on participants' emotions, moods, and PEB.

Destruction Experience in Virtual Reality

VR experiences are known to have a strong influence on users' psychology and behavior due to their high levels of immersion and sense of agency. For example, participants who experienced flying like a superhero in a VR environment were found to exhibit more altruistic behaviors in the real world, suggesting that active experiences can induce positive behavioral change (Rosenberg, 2013). Thus, active experiences in environments with a strong sense of agency are effective in promoting psychological and behavioral transformation.

Among various active experiences, destruction-based activities involve intense physical and sensory stimulation, and those intense stimuli are hypothesized to trigger excitement and pleasure.

For instance, it has been reported that participants who engaged in smashing ceramic or glass objects in VR expressed positive feedback such as "fun" and "refreshing" (Persson, 2021). On the other hand, while destructive acts can function as a form of catharsis for releasing anger, they have also been associated with increased aggression and hostility (Bushman, 2002 and Kjærvik, 2024).

Development of the VR Destruction Task

Figure 1 shows the scene during the VR destruction experience developed in this study. As a VR destruction task, a two-choice quiz format related to environmental issues was adopted. In the task, participants were presented with 10 multiple-choice questions in the VR environment (e.g., "Which is a greenhouse gas?" A: Carbon dioxide, B: Oxygen). Participants answered by destroying the panel corresponding to the option they believed to be correct using a handheld stick.

Since the purpose of this task is not knowledge acquisition but the destruction experience itself, the quiz questions were intentionally designed to be simple and focus on basic environmental knowledge. When a correct answer was selected, visual and auditory feedback was implemented to enhance the

sense of exhilaration and achievement. The task was developed using Unity, and the VR device used for the experience was Meta Quest 2.

Figure 1: VR environment during the experience.

Experimental Method

An experiment was conducted to evaluate whether the developed VR destruction task could evoke feelings of exhilaration and achievement and thereby contribute to the promotion of PEB. The experiment involved ten students from Kyoto University, divided into two groups: 5 participants in the test group, who performed the VR destruction task, and 5 participants in the control group, who experienced a non-destruction version of the task in which they simply passed through the panels without breaking them. The participants were aged between 18 and 24 years, consisting of 4 males and 6 females.

To assess participants' mood and emotional states, the Multiple Mood Scale (MMS) (Terasaki, 1992) was used. The MMS is a questionnaire designed to evaluate affective and mood states, consisting of ten items per subscale and measuring multiple emotional factors. In this study, six factors—Active Pleasure, Passive Pleasure, Fatigue, Anxiety/Depression, Astonishment, and Hostility—were selected to examine the reduction of psychological burden and the induction of positive emotions through the VR destruction task. For each factor, the five items with the highest factor loadings were used, and participants rated them on a five-point Likert scale. Additionally, a post-experience questionnaire was administered to evaluate subjective impressions such as pleasure and a sense of accomplishment. The questionnaire consisted of six items: "Did you feel refreshed?", "Were you absorbed in the VR experience?", "Were you satisfied with the VR experience?", "Did you feel a sense of accomplishment?", "Did the experience relieve tension or stress?", and "Did you feel fatigue?" Responses were obtained on a five-point Likert scale.

To measure the promotion of PEB, the Pro-Environmental Behavior Task (PEBT) (Lange, 2018) was employed. In the PEBT, participants choose between two transportation options on each trial: one with low environmental impact but longer waiting time, and another with high environmental impact but shorter waiting time. The task consists of 24 trials with varying combinations of waiting times. In this study, participants completed PEBT

both before and after the VR task, and the change in the number of environmentally friendly choices was used as a behavioral indicator of PEB promotion. Since the PEBT was administered twice in a single session, a shortened version of 24 trials was used to reduce participant burden while maintaining task validity.

The overall procedure of the experiment is illustrated in Figure 2. Prior to the start of the experiment, participants were briefed on the study's aims and procedures. After the briefing, participants completed a short practice session to familiarize themselves with the controls of the VR device. In addition, participants were given a practice session of PEBT to ensure that they understood the structure and decision-making process of the task. After completing the practice sessions, the experimental sequence proceeded as follows: MMS (pre-task), PEBT (pre-task), VR destruction task, MMS (post-task), PEBT (post-task), and finally the post-experience questionnaire.

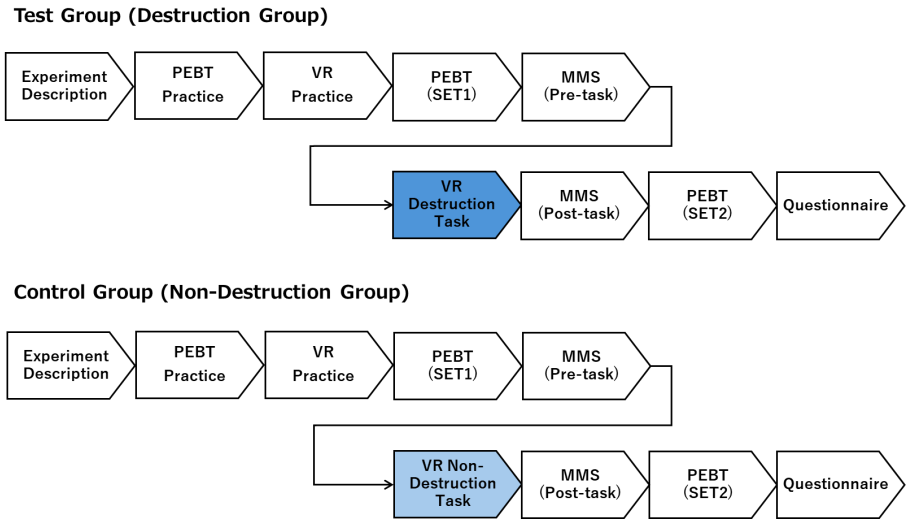

Figure 2: Experimental procedure.

Results

Table 1 shows the results of the PEBT, displaying the mean scores for both the test and control groups. The results indicate that the test group showed an increase in scores, while the control group exhibited little change. This suggests that the developed VR destruction task may have the potential to promote PEB.

Table 1: The result of PEBT.

	Test (n = 5)	Control (n = 5)
Pre-task	14.0	14.6
Post-task	15.2	14.4
Change	+1.2	–0.2

Subsequently, Table 2 presents the results of the MMS, which was conducted to evaluate changes in mood and emotional states. The total scores for each factor were calculated, and the average changes before and after the experience were compared. As a result, the test group showed an increase in Active Pleasure and a decrease in Inactive Pleasure.

Table 2: The result of MMS.

	Test (n = 5)	Control (n = 5)
Active Pleasure	+1.4	–0.6
Inactive Pleasure	–3.4	+0.4
Fatigue	–1.0	–0.8
Anxiety/Depression	–0.8	–0.8
Astonishment	+1.4	–0.2
Hostility	+0.8	±0.0

Finally, Table 3 shows the results of the post-experience questionnaire. The mean scores for all items were high in the test group, confirming that the designed task might elicited feelings of exhilaration and satisfaction.

Table 3: The results of the post-experience questionnaire.

	Test (n = 5)	Control (n = 5)
Refreshed	3.6	2.0
Absorbed	4.4	3.0
Satisfied	4.6	3.4
Accomplished	4.2	3.2
Relieve tension	4.0	2.2
Fatigue	1.6	3.6

DISCUSSION

The results of this study indicate that the developed VR destruction task effectively elicited positive emotions such as exhilaration and a sense of achievement. The observed increase in Active Pleasure and decrease in Passive Pleasure suggest that participants experienced physically and actively induced positive emotions rather than calm or passive pleasantness. Moreover, the minimal change in the Hostility factor demonstrates that, despite involving destructive actions, the task was designed to avoid eliciting aggression or negative effects.

However, several limitations must be acknowledged. The most significant is the small sample size (n = 10), which restricts the statistical generalizability of the findings. Additionally, since the study focused on short-term effects, the long-term influence of positive emotional experiences on sustained PEB remains unclear. Future research should employ a larger sample and longitudinal design to validate the robustness and persistence of these effects.

CONCLUSION

This study proposed and tested a VR destruction task designed to evoke positive emotions such as exhilaration and a sense of achievement as a novel approach to promoting PEB. The findings demonstrate that such an experience can induce active and enjoyable emotional states without triggering aggression, and that these emotions may contribute to enhancing pro-environmental decision-making.

Future work will involve a larger-scale experiment to statistically verify the effects of the task.

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