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An Examination of Visual Influences on Sense of Ownership and Agency.

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SUMMARY

- This study investigates the influence of vision on the sense of ownership and agency in VR.
- Overall, this study contributes to the broader understanding of how individuals perceive and interact with their own bodies and external objects within virtual environments.

INTRODUCTION

A sense of ownership refers to "the sense that a certain event occurs in one's own body," while a sense of agency refers to "the sense that one causes a certain event to occur in one's own body."

In this study, cat paws, which are visually different from human hands, were presented in a VR space to examine their effects on the sense of ownership and agency. We examined the effects of stimuli that are visually different from human hands that can move by themselves on the sense of ownership and agency.

In the Experiment, the subjects grasped an object and carried it to a designated position.

APPROACH

Visual stimuli were presented on an HMD.

We used two stimuli (human hand, and cat paw).

The stimuli generated Blender and Unity.

In Experiment, subjects grasped an object and carried it.

Subjects were asked questions related to the sense of ownership and agency and questions related to movement

METHODS

16 subjects (16 males, mean age 21.82) participated in the experiment.

The questionnaire of sense of ownership was (Q1) I felt like I was looking at my own hands, (Q2) The CG hand felt like a part of my body, (Q3) The CG hand felt like my hand, and (Q4) I felt that he had a hand other than his right hand. The questionnaire of sense of agency was (Q1) The CG hand felt like my own movement, (Q2) The CG hand could be moved as I wanted, (Q3) The CG hand felt like someone else's movement, and (Q4) The CG hand seemed to move on its own (reversed). After all the sections, I knew how the stimuli moved in the real world.

RESULTS

An analysis of variance by ANOVA was conducted with stimulus type, timing condition (synchronous or asynchronous), and questionnaire results as within-subject factors (2 stimulus type × 2 timing × 9 questionnaire). The analysis of variance revealed the main effect of the timing condition [F (1, 15) = 47.91, p < 0.01] and the main effect of the questionnaire [F (8, 120) = 8.47, p < 0.01] were significant. The interaction between stimulus type and questionnaire results [F (8, 120) = 12.15, p < 0.01] and timing condition and questionnaire results [F (8, 120) = 32.08, p < 0.01] was also significant. Simple effects for "A x C" interaction showed a significant difference between human and cat paw stimuli [F (1, 15) = 34.14, p < 0.01] in Q1.

The number of items that were significantly different from 0 is summarized for Experiment in Table 1.

Table 1. Summary of the results of Experiment 1.

	A sense of Ownership		A sense of Agency	
	Synchronous	Asynchronous	Synchronous	Asynchronous
Human hand	4	2	4	2
Cat paw	3	3	4	1

ANALYSIS

An analysis of variance was performed on the data obtained.

95% confidence intervals were obtained for the data obtained. The 95% confidence intervals were used to examine significant differences between timing conditions and significant differences between the 95% interval and zero evaluation scores. The greater the number of items with a significant difference from 0, the more ownership and agency occurred in the synchronous condition, and the less ownership and agency occurred in the asynchronous condition.

DISCUSSION

Two findings were made.

The first is that cat paw stimuli bring about a sense of ownership. This phenomenon is likely due to the influence of cat paw stimuli on the sense of ownership.

Second, it was observed that cat paw stimuli affected the sense of ownership and agency. It was suggested that a human hand is better for a strong sense of ownership, but that a sense of ownership can be achieved if the behavior is consistent.

CONCLUSIONS

1. Human hand stimuli consistently evoked a stronger sense of ownership. Visual similarity was found to be important.
2. The sense of agency was evident across all stimuli. Suggested that it is important that the visual stimuli move at the same time as the subject moves.
3. Cat paw stimuli appear to enhance the sense of ownership, while the perception of stimuli as tools might affect the sense of agency.

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