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Abstract (Doctor)

Title of Thesis	Effectiveness of Inducing the Sense of Body Ownership over Un-humanoid Avatar for Flying Tele-Existence
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Approx. 800 words

Users can interact with a distal environment by transmitting sensory information while within it. This technology is referred to as tele-existence. Recent tele-existence studies are treating a drone to work in various fields where a person cannot see directly, such as rescue on the ocean and disaster investigation. That is referred to as flying tele-existence. One of the main issues with operating a drone is to prevent accidents due to complicated operations. Therefore, previous works have been proposing user interfaces in which a person can understand a way to fly intuitively and a device that provide haptic simulation depending on the distance between a drone and an obstacle, and so on. However, in consideration of required cognitive function when driving a vehicle, meanwhile they have been focused on operability, these studies have not focused on psychological aspects (e.g., the spatial awareness and the fear of heights). We proposed the sense of body ownership-based support system to support psychological aspects. The sense of ownership is a feeling that indicates a feeling of recognizing a virtual body as our own body. Operators cannot see a visual body when using common drone operation systems. On the other hand, this proposal method depicts an avatar for flying tele-existence to improve spatial awareness and obtain positive psychological effect by building the physicality (i.e., the sense of body ownership).

We use un-humanoid avatars (e.g., a bird avatar and a dragon avatar) to obtain the feeling of the size of a drone and reduce the fear of heights. Those avatars do not have discomfort even in those shapes that are reshaped into a drone shape. It can be expected that it reduces the fear of heights because of a preconception having a flight ability. First, we investigate the possibility of whether it is possible to induce the sense of body ownership into un-humanoid avatars because it has not been reported about inducing the sense of body ownership into them. We conduct on the experiment that participants operate either a bird avatar or a human avatar to compare the intensity of the sense of body ownership. Second, we conduct the experiment that evaluates the task performance of spatial awareness to investigate the effectiveness of the sense of body ownership for spatial awareness. Finally, we conduct on the experiment that participants operate either a dragon avatar or a bird avatar while facing heights to reduce the fear of heights using the psychological effect of a dragon avatar.

As a result of the first experiment, we could induce the sense of body ownership into a bird avatar. Results of the second experiment shows task performance for

spatial awareness can be improved by inducing the sense of body ownership. As a result of the third experiment, in comparison with a human avatar, a dragon avatar could reduce the fear of heights. Taken together, the sense of body ownership is effective for spatial awareness and a dragon avatar can reduce the fear of heights. Thus, we could develop the sense of body ownership system for supporting psychological aspects.