The effect of continuous VR avatar size change on user grip strength

2310177 Gaku Yoshikawa

In recent years, grip strength has been attracting attention in Japan as an indicator of people's health status as the country enters a super-aging society. It has been reported that grip strength of men and women generally peaks around the age of 30s and declines with age thereafter. In addition, it has become clear that grip strength and various other muscular functions of men and women in their teens to thirties have been declining further compared to the past decade. This decline in grip strength and other muscle Sicknesses, especially among young people, has become a problem because of the assumed risk of various diseases caused by lack of exercise.

In response to this situation, research has already been conducted in Japan to improve people's grip strength and other muscle strength, and results such as improved grip strength and cognitive function have been reported for the elderly and children. On the other hand, there have been few studies on young people in their teens to thirties, suggesting the need for further research to improve grip strength.

In recent years, with the development of VR technology, research using the Proteus effect with VR avatars has been attracting attention to address the problem of muscle weakness, including grip strength. The Proteus effect refers to a phenomenon that psychological effects are generated when an avatar in a VR space is perceived as if it were a part of one's own body.

One example of such research is the expansion of body motion and changes in self-perception in VR space using the Proteus effect with VR avatars. In these studies, for example, it has been reported that the use of a VR avatar of a muscular man gives the user the illusion of a stronger body, improves grip strength, and reduces fatigue during exercise. However, I believe that VR avatars with physical characteristics such as excessive muscles and feminine physique may reduce the sense of immersion and body ownership, as well as the Proteus effect, because the impression received from the VR avatars differs among subjects.

Therefore, to increase the influence of the Proteus effect on body motion while reducing differences in the sense of immersion in the VR avatar among subjects, this study presented VR avatars with few excessive physical features to subjects using a video representation in which the surface layer changes continuously and verified the influence of the Proteus effect on grip strength. This study examined the effect of the Proteus effect on grip strength.

In this study, two research issues were raised. First, how do VR avatars with few excessive physical features affect subjects' sense of immersion and sense of body ownership? Second, how does the image representation in which the surface layer of the VR avatar changes continuously affect the Proteus effect and grip strength

generated in subjects compared to the image representation in which the surface layer does not change continuously?

To address the above research questions, I focused on a human hand as a VR avatar with few physical characteristics and selected a VR avatar with its surface layer enlarged or reduced as the VR avatar used for verification. In this study, I first verified the subject's sense of physical possession and immersion in each of the above selected avatars. Then, I presented the surface layer of each avatar to the subjects with and without continuously changing images and verified the Proteus effect generated and its effect on grip strength.

As a result of the verification, it became clear that the hand VR avatar with few physical characteristics generated a high sense of immersion and a sense of body ownership for the subjects for the first research subject, and that the difference in the sense of immersion between subjects was reduced.

Next, for the second research question, I showed that the Proteus effect, which uses powerful impressions generated by the subjects, is less pronounced in the image representation in which the surface layer of the hand VR avatar continuously changes compared to the image representation in which the surface layer does not continuously change, and that the grip strength is reduced. In addition, when the surface layer of the VR avatar of the hand did not change continuously, the presentation of the VR avatar with an enlarged surface layer (enlarged avatar) strongly affected the Proteus effect using powerful impressions, and grip strength increased.

I believe that the results of this study will contribute to solving the problems in existing VR research where physical characteristics of avatars cause a decrease in the sense of physical possession and immersion. In addition, it is expected that the conditions for generating the Proteus effect will be expanded and applied to further efforts to extend physical exercise using simpler VR systems and to improve grip strength in young people.

I believe that the results of this study will contribute to solving the problems in existing VR research where physical features of avatars cause a decrease in the sense of physical possession and immersion. In particular, the method proposed in this study that uses VR avatars with few physical features such as muscles is expected to expand the conditions for generating the Proteus effect and to be applied to further efforts to extend physical movement using simpler VR systems and to improve grip strength in young people.

In addition, I believe that the practicality of physical exercise using the Proteus effect will be enhanced by clarifying whether the Proteus effect generated by the VR avatars of selected hands repeatedly affects the increase in grip strength in the future.