Understanding the Effect of Visual Object Weight on Pointing Movements in Virtual Reality

Thema:
Understanding the Effect of Visual Object Weight on Pointing Movements in Virtual Reality
Art:
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BetreuerIn:
Alexander Kalus
BearbeiterIn:
Lee-Ann Seegets
ErstgutachterIn:
Niels Henze
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Hintergrund

The weight of handheld devices affects how we perform pointing movements [1, 2]. Interestingly, a recent study indicates that the visual representation of the controller weight in VR may have an effect on movement time [3]. Participants achieved lower movement times with a lighter-weight visual model compared to a heavier model. For VR designers, it is of interest whether this effect could be utilized to improve user performance by modifying the visual weight of objects held in VR according to application requirements. Virtual tools, for example, could be rendered with lower visual weight when more reaction time is required. For tasks that rely on precise movements, tools could be designed to appear heavier.

However, it is still unclear how users adjust their movements to the visual weight for the movement time to be affected. For a better understanding of the effect on movement time and its implications, it is necessary to investigate how the visual weight affects not only movement time but also motion paths, velocity, and acceleration.

Zielsetzung der Arbeit

This thesis aims to examine the effect of visual weight of objects held in VR on movement time, motion paths, velocity, and acceleration in pointing tasks. The VR environment implemented for this study will comprise four virtual dumbbells that will be used as pointing devices, ranging from light to

heavy in visual weight. Participants will use a 3D printed controller to destroy a series of targets using each of the virtual pointing devices. For each pointing device, the trajectory, velocity and acceleration of the controller movements will be tracked.

Konkrete Aufgaben

- 3D printing a physical controller
- Implementing appropriate visual models
- Implementing a VR environment with targets for pointing
- Tracking the trajectory, velocity and acceleration
- Designing and conducting the study

Erwartete Vorkenntnisse

- Knowledge in Unity
- Knowledge in performing studies
- Programming skills

Weiterführende Quellen

[1] Burkitt, J. J., Staite, V., Yeung, A., Elliott, D., & Lyons, J. L. (2015). Effector mass and trajectory optimization in the online regulation of goal-directed movement. Experimental brain research, 233 (4), 1097–1107. https://doi.org/10.1007/s00221-014-4191-7

[2] Elliott, D., Lyons, J., Hayes, S. J., Burkitt, J. J., Roberts, J. W., Grierson, L. E., Hansen, S., & Bennett, S. J. (2017). The multiple process model of goal-directed reaching revisited. Neuroscience & Biobehavioral Reviews, 72, 95-110. https://doi.org/10.1016/j.neubiorev.2016.11.016

[3] Kalus, A., Lanzinger, M., Rolny, L.,Strasser, B., & Bogon, J. (2023). The Effect of Controller Weight and Visual Representation on Performance, Presence, and Realism in Virtual Reality. (under preparation)