Title: No end-state comfort in sight? Using Virtual Reality to measure how different visualizations of one’s body changes eye and hand movements during an object interaction task.

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Abstract: 1.18

Rosenbaum and colleagues (1990) demonstrated that participants will adopt an initially awkward posture (e.g. grasping a wine glass thumb-down) to increase comfort of the end state of the movement (e.g. ending with thumb-up to invert the glass). They argued this requires second-order movement planning - altering movement parameters not just for the immediate task but also for the next task (Review: Rosenbaum et al, 2012). But, what is comfortable? The term “end-state comfort” implies it is the physical body posture that is being considered. However, it’s possible that humans plan movements that visually appear comfortable (Flanagan and Rao, 1995). We tested this hypothesis by recreating in Virtual Reality (VR) a task we previously conducted in the real-world (Lavoie et al, 2018). Participants used an HTC Vive controller to move a virtual Pasta Box to various shelf locations, presented in a Vive headset with PupilLabs eye-tracking. Participants completed 20 trials, then filled out an embodiment / agency questionnaire, in each of two body-visualization conditions: 1) Controller: the positions and orientations of the real controllers were reproduced in VR; 2) Arms: virtual hands and arms accurately reflected the positions and orientations of the real controllers. Eye movements in VR were similar across conditions and to our real-world data. However, despite identical control mechanisms, we noted profound differences in movement driven entirely by body-visualization. Compared to the Controller condition, in the Arms condition participants extended their wrist such that the virtual thumb and forefinger appeared to grasp the side of the Pasta Box, and these “Grasps” occurred lower on the box. This shaping of movement by body-visualization corresponded with an increase in the Ownership and Embodiment scales of the questionnaire. Overall this suggests our movements are planned to provide optimal visual feedback, even at the cost of less efficient kinematics.