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# Comparison of Performance for Visual Feedback and Cursors in Mid-Air Grasping of 3D Objects

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**Abstract**
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## Abstract

BACKGROUND: Pseudo-Haptics, cross modal perceptions that can create the illusion of physical sensation, or haptic feedback, have shown promise in improving user experience of virtual reality simulations, particularly those experiences that utilise freehand, mid-air type interactions, which cannot provide haptic feedback to users. However, they have shown mixed results in improving the performance of users in such cases. One hypothesis that explains the mixed results of user performance benefits is that the feedback provided by pseudo-haptics is something that users look and wait for before carrying out a task, which results in no increase in performance. This would still explain why, for more complex tasks, user performance does improve, as any feedback at all may improve performance. As such, providing cursors to better guide actions such as grasping objects may provide better performance and more confidence in users when utilising such systems.

OBJECTIVE: To gather evidence relating to the mechanisms behind the disparity in the results of studies regarding the benefits to user experience and performance in order to provide better guidelines for the design of mid-air interaction based virtual reality simulations.

DESCRIPTION OF WORK: The study will involve an experiment in a virtual reality simulation using free-hand interaction. The simulation itself will feature a simple grasp and release task, performed multiple times in order to gather data on user performance. The task will be performed several times with different feature sets. Common visual feedback techniques will be used, including object highlighting and the highlighting of the user's hand avatar when an object can be grabbed. These will be tested against two different types of cursors, one showing the area around the hand that determines when an object can be grabbed, and a smaller dot cursor placed in the center of that space. During the test, objective data will be collected including the amount of time it takes for the user to complete the task, user accuracy and error rates and the total hand movement during the task. Afterwards, subjective data will also be collected, including user confidence when interacting with the system and preferred feature set.

IMPACT: Based on the data collected, evidence will be collected either for or against the hypothesis, which will be able to help provide recommendations regarding best design practices for future mid-air interaction systems.