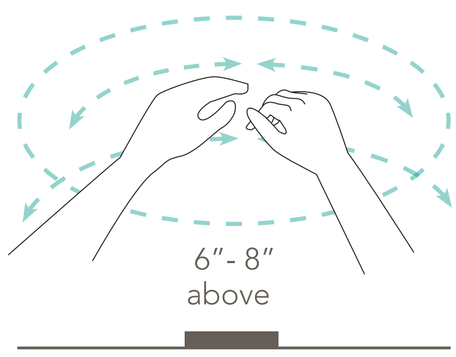
Designing Physical Interventions to Improve Gestural Interactions with Science Simulations

Champaign, Illinois, USA

Abstract

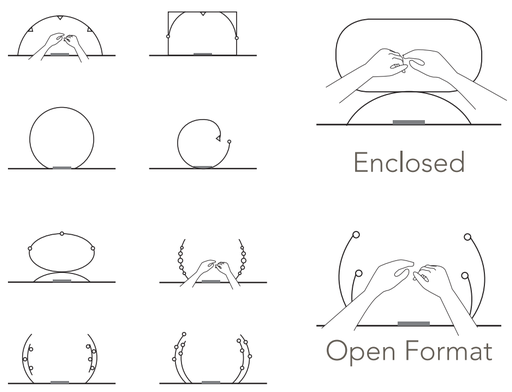
This paper explores the collaborative process of designing a physical object to support a National Science Foundation funded educational research project. Researchers involved with this project are exploring the ways in which gesture can aid in a student's ability to construct explanations of science phenomena, particularly ones that have unseen structures and unobservable mechanisms. In order to manipulate the science simulations, a motion sensitive device captures students' hand gestures. It can be difficult for students to know how to engage with this device, which impedes both student learning and associated research. In order to reduce usability challenges and enhance the connection between a student's gestures and the scientific concepts presented on the simulation screen, a collaborative and iterative design process was conducted to create a designed form that would assist students in productively engaging with the simulations. The iterative development process of this project is an exemplar of how designed items can be developed to support multidisciplinary research projects, while also creating new fields of research. Future exploration of this device's impact on student interaction and learning may bring to light how objects can change how people gesture in learning contexts, leaving a lasting imprint on their understanding and memory.

Visualizing Space



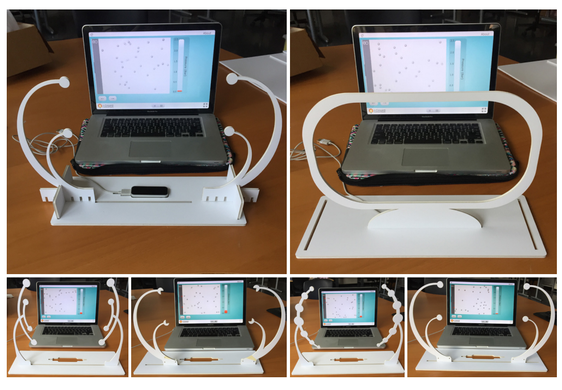
The LEAP Motion device has a specific gesture zone for optimal performance, student participants need guidance to visualize that space.

Concept Sketching



Initial concept sketches (front view) of the hand guide device. These sketches fall into two categories: enclosed hand guides and open format hand guides.

Low Fidelity Prototyping

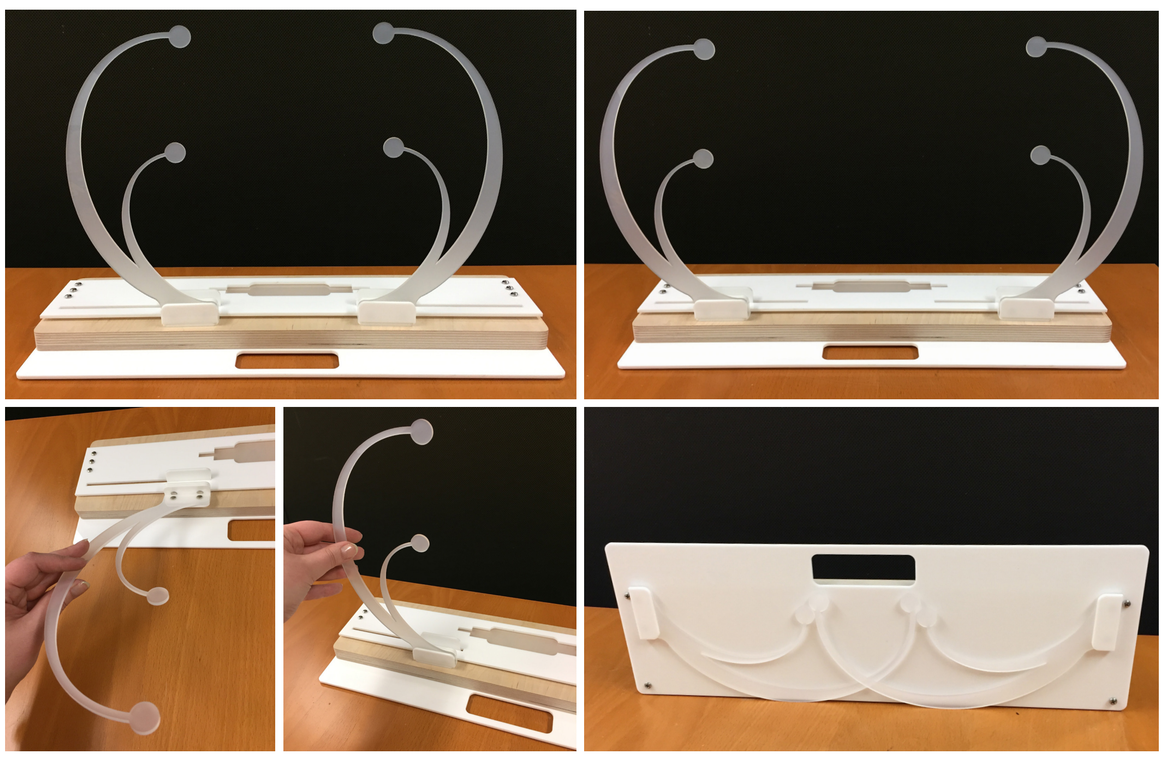


Low fidelity prototypes of an enclosed hand guide and an open format hand guide. As well as some form iterations of the open format guide were tested.

Early User Testing

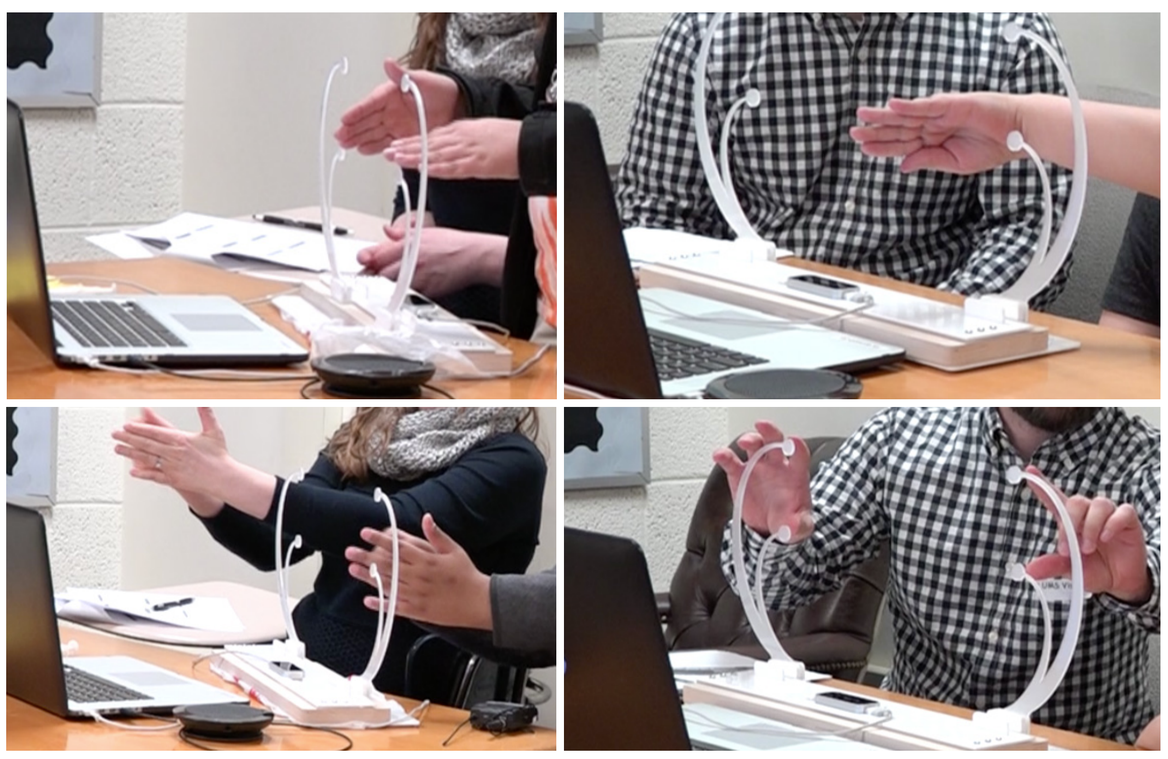
Students working in a dyad interacted with the low fidelity models providing feedback on their experience. They preferred the open format model.

Final Form



The current model is constructed out of laser cut acrylic, plywood, magnets, and fasteners. The device can be carried with the hand guides magnetically fastened to the side. When in use, the hand guide pieces magnetically attach to two sleds that can be moved left and right to accommodate for gesture width. The base of the device has an area for the LEAP motion to rest securely throughout testing.

User Testing



The device gives participants a reference within their visual field of where the researcher indicated that they should complete their gestures throughout their interaction with the simulation. In early use, researchers reported that having the hand guide device has been advantageous. Further testing needs to be completed to document the impacts of its use and continue shaping further design iterations.

re: research research research

Acknowledgements

GRASP is a collaboration between the University of Illinois at Urbana-Champaign and the Concord Consortium. This material is based upon work supported by the National Science Foundation under Grant No. DUE-1432424. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. We would also like to thank the whole GRASP team for their help in testing and giving input on the design work described here.

Authors

Amanda Henderson

Robb Lindgren

Organization

University of Illinois

Urbana-Champaign

iasdr 2017

University of CINCINNATI

D | A | A | P