GT Sonification Lab

Air Gesture Based Systems for Accessible STEM Education

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PURPOSE

Gestures are explored as an effective interaction method for students with visual impairments to access STEM educational tools in the form of interactive web-based simulations.

RATIONALE

- The knowledge base of teachers of K-12 students who are visually impaired in science is limited [Supalo et al, 2013].

- Engaging curricular materials offer a wide range of metacognitive and content-specific instructional supports [Basham et al, 2010].

- These allow students to move through an experience and make repeated choices to learn concepts [Helsel, 1992].

- Creating real-world physical models for exploratory learning is expensive and assistive technologies are inadequate.

- Studies further show different mid-air gestures from sighted individuals for example in the use of metaphoric gestures (Dim et al, 2016)

METHODOLOGY

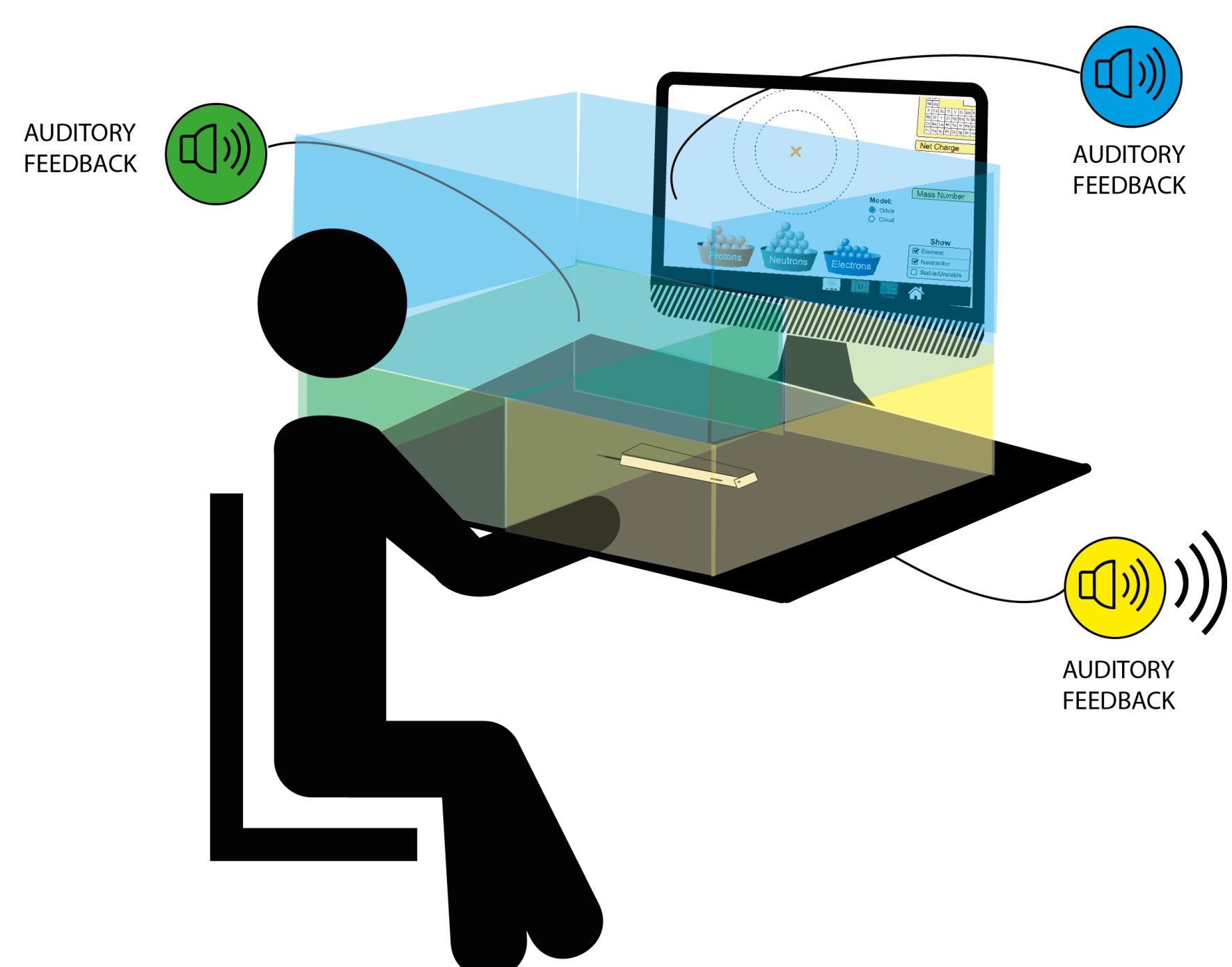1. Prototype 3D air gesture input via Leap Motion for Javascript-based simulations

Diagram showing the gestural areas of interaction for one simulation to "build an atom" with the auditory setup for feedback around the Leap Motion device.

2. As gesture sets produced in collaboration with users tend to be more usable than designed sets (Morris, Wobbrock and Wilson, 2010), we undertake a gesture elicitation study with visually impaired users.

3. Combining the produced gesture sets with auditory feedback.

4. Testing usability of different gesture sets.

Basham, J. D., & Marino, M. T. (2010).Introduction to the topical issue: Shaping STEM education for all students. Journalof Special Education Technology, 25(3),1-2. | Helsel S. (1992), Virtual Reality and Education. Educational Technology, 32(5), 38-42. | Meredith Ringel Morris, Jacob O. Wobbrock, and Andrew D. Wilson. 2010. Understanding users' preferences for surface gestures. In Proceedings of Graphics Interface 2010 (GI '10). Canadian Information Processing Society, Toronto, Ont., Canada, Canada, 261-268. | Nem Khan Dim, Chaklam Silpasuwanchai, Sayan Sarcar, and Xiangshi Ren. 2016. Designing Mid-Air TV Gestures for Blind People Using User- and Choice-Based Elicitation Approaches. In Proceedings of the 2016 ACM Conference on Designing Interactive Systems (DIS '16). ACM, New York, NY, USA, 204-214 | Supalo, C. A., Isaacson, M. D., & Lombardi, M. V. (2013). Making Hands-On Science Learning Accessible for Students Who Are Blind or Have Low Vision. Journal of Chemical Education, 91(2), 195-199. | Image credits - LeapMotion website: https://www.leapmotion.com/product/v2

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