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Skill Transfer Across the Scales of a Tangible User Interface

Background

Typical elements of Tangible user interfaces (TUIs) include physical knobs, sliders and buttons. TUIs are widespread in users' everyday and professional life. Example applications of use are airplane cockpits, sound and light mixing consoles, color grading consoles, car controls, etc. Current TUIs exist in different sizes. For instance, sliders are manufactured in a range from 1cm to 10cm. Recent advances allow to imagine TUIs that can adapt their size according to the users' needs and the available space. As a consequence, users have to rescale their sensori-motor abilities or skills to achieve similar tasks using TUIs varying in size.

Research question

As a person uses an interface, s/he learns new motor skills to become an expert user of the interface. If the size of the interface can vary across situations of use, how well will the users' skills acquired *with a particular scale* transfer *to a smaller or larger scale*? Some parameters such as the properties of the task may also affect transfer. A better knowledge of these parameters will help designers improving TUIs.

Importance

Filling in the gaps of current knowledge about users' adaptation is essential to reshape the User Interfaces of tomorrow. In the critical domains where TUIs are widely and successfully used (cockpit, cinema, hospitals, etc.), the lack of skills' transfer could costs money, usability, mobility and, sometimes, even security. Unexpected interferences between TUIs could also have negative consequences.

References

The ability to learn and adapt sensori-motor skills to different situations is extensively investigated in motor control literature, e.g. [3]. This research field is providing experimental paradigms and theoretical frameworks that can help designers to evaluate and improve Human Computer Interaction (HCI) [1]. The current project is at the crossroad of Motor Control (Cognitive Sciences) and HCI (Computer Science). Our approach will be based on recent studies of dynamics learning across changes in movement amplitude [4] and studies of users' performance with a shape-changing tangible slider [2].

1. François Bérard and Amélie Rochet-Capellan. 2015. The Transfer of Learning as HCI Similarity: Towards an Objective Assessment of the Sensory-Motor Basis of Naturalness. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 1315-1324). ACM.

2. Céline Coutrix and Cédric Masclet. 2015. Shape-Change for Zoomable TUIs: Opportunities and Limits of a Resizable Slider. Proceedings of the 15th IFIP TC13 Conference on Human-Computer Interaction (INTERACT'15), September 14-18, 2015, Bamberg, Germany, Springer.

3. John A. Krakauer and Pietro Mazzoni. 2011. Human sensorimotor learning: adaptation, skill, and beyond. *Current opinion in neurobiology 21*, 4, 636–644.

4. Andrew A G Mattar and David J Ostry. 2010. Generalization of dynamics learning across changes in movement amplitude. Journal of neurophysiology 104, 1: 426–438. http://doi.org/10.1152/jn.00886.2009

Objectives of the internship

During the 5 months time of the project (February to June 2016), the student is expected to:

- Review related work in both motor control and human-computer interaction fields,
- Design an experiment assessing the skill transfer across the scales of one or two typical tangible widget (e.g., a slider and/or a knob)
- Make the tangible widgets using local FabLabs like FabMSTIC (http://fabmstic.liglab.fr),
- Track the tangible widgets with the local high performance Optitrack system (http://www.optitrack.com),
- Implement the experiment's software,
- Conduct the experiment,
- Analyze the results of the experiment,
- Write and defend her/his master's thesis.

For all these steps, previous work, material and experience from both supervisors will help to get a start and improve the student's work.

Applicants

The internship requires good coding skills. Statistics skills are a plus.