
Designing tactile feedback for midair interaction in virtual environments

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Abstract

Haptic cues aren't novel to real life user interfaces but to virtual ones especially in midair interaction. Hence besides technical considerations the question is whether findings regarding the strength of the haptic cue can be transmitted from contact based interfaces to midair interaction in order to ensure an efficient interaction. Furthermore the signal design process for intuitive use is of interest. Here established hardware interfaces may give examples for feedback patterns. Creating and following a valid approach on designing feedback cues will increase the acceptance of midair feedback and the usability natural user interfaces.

Author Keywords

Intuitive Use; Feedback Design; Ergonomics; User Centered Design

ACM Classification Keywords

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Position Statement

Haptic feedback has always been inherent in most commercial user interfaces. But within so called natural user interfaces for virtual and augmented applications, haptic feedback needs to be reintegrated in interfaces. Here novel contactless interfaces like sound or gesture

Feedback alternatives



Figure 1: Vortex canon

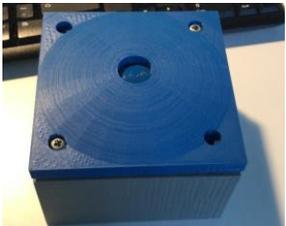


Figure 2: Contact based simulator

input create a highly instinctive interaction. However the loss of haptic feedback may cause high mental workload for novel users and limit the performance within visually demanding situations [1]. This effect can be explained by the multiple resource theory [2] which postulates that multiple modalities within stages increase user's performance in comparison to single use of modalities. Hence cross-modal feedback like visual-auditory and visual-tactile should in theory result in higher performances under high mental workload.

Investigating haptic or tactile feedback for midair interaction requires a valid analysis subject. However current feedback prototypes of vortex canons (fig. 1) don't provide sufficient feedback parameters. Furthermore, in terms of ultrasonic feedback generators the measurement of the exact pressure at the hand is challenging. Hence for the identification of feedback parameters we build contact based simulator (fig. 2). To realize haptic sensations a 1.8 cm in diameter piston, driven by magnetic force creates a constant and adjustable pressure. To transfer experimental deliverables contact based and contactless systems need to stimulate the same receptors. In this case both systems (vortex and contact based) generate feedback by pressure which is received by Meissner's corpuscles. Ultrasound otherwise incorporate Pacinian corpuscles for the detection of vibrations. Thus our approach is to determine valid and reliable comfort zones for tactile feedback for midair interaction by utilizing a contact based feedback simulator. Later on the determined values are transmitted into an experiment including an advanced vortex canon for midair interaction. Here the previously derived pressure values should be used to provide feedback within a high mental workload test setting.

Following the theory, results should indicate an advantage in task performance for visual-tactile feedback in comparison to visual-auditory feedback.

Furthermore feedback coding under the use of the virtual hand metaphor is of interest. In order to create an intuitive feedback the use of already known pattern is recommended [3]. To provide feedback after discrete selection tasks feedback patterns from smartphones or keyboard and mouse will be tested against generic one. Furthermore the immediate response after the system control (e.g. correct or incorrect) should be derived from smartphones or video game controllers. In contrast continues feedback given in advance (e.g. guiding to an active element, indication of tracking borders) has to be derived from more generic approaches like the H-E-Vocabulary [4].

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