

Measuring haptic latency and visuo-haptic synchronization

Durée : 6 mois

Équipe : Loki (Inria Lille – Nord Europe & CRISAL)

Encadrant(s) : [Thomas Pietrzak](#) & [Géry Casiez](#) (prenom.nom@univ-lille.fr)

Description

End-to-end latency, measured as the time elapsed between a user action on an input device and the update of visual, auditory or haptic information is known to deteriorate user perception and performance [3]. The synchronization between visual and haptic feedback is also known to be important for perception. While tools are now available to measure and determine the origin of latency on visual displays, a lot remains to be done for haptic actuators. In previous work, we designed a latency measurement tool, and used it to measure the latency of visual interfaces [1]. Our results showed that with a minimal application, most of the latency comes from the visual rendering pipeline.

While visual systems are designed to run at 60Hz, haptic systems can run at much higher frequencies up to 1000Hz. This means the bottleneck of haptic interfaces might be different from visual interfaces. There might also be large differences between different kind of haptic actuators, some of them being designed to be highly responsive [4]. Moreover, the perception of temporal parameters of haptic stimulations is different than for visual stimulations [2][5]. We foresee influences on the perception of latency between haptic and visual interfaces.

This work will consist in:

- Studying related work on latency, and haptic systems.
- Designing a haptic latency measurement tool, based on previous work [1].
- Measure latency of various haptic systems.
- Study haptic-visual synchronization.

Candidate

The ideal candidate is a MSc student or equivalent with a major in computer science, and shows a great interest in HCI research. He must have experience or a strong interest in software and hardware development. Creativity, independence, team work as well as great communication skills are valuable advantages.

Working environment

The internship will take place in the [Loki](#) team in Lille, France, joint between [Inria – Lille Nord Europe](#) and the [CRISAL \(UMR CNRS 9189\)](#) laboratory of the [University of Lille](#). Supervisors: [Thomas Pietrzak](#) and [Géry Casiez](#). This work is a collaboration with [Oliver Schneider](#), from the [University of Waterloo](#).

Bibliography

- [1] Casiez, G., Pietrzak, T., Marchal, D., Poulmane, S., Falce, M., Roussel, N. *Characterizing latency in touch and button-equipped interactive systems*. 2017. UIST 2017, 29–39.
- [2] Goodfellow, L.D. *An empirical comparison of audition, vision, and touch in the discrimination of short intervals of time*. 46 (1934), 243–258.
- [3] Jota, R., Ng, A., Dietz, P., Wigdor, D. *How fast is fast enough?: A study of the effects of latency in direct-touch pointing tasks*. 2013. Proc. CHI '13, 2291–2300.
- [4] Moortimer, B.J.P., Zetz, G.A., Cholewiak, R.W. *Vibrotactile transduction and transducers*. 5, 121 (2007), 2970–2977.
- [5] van Erp, J.B.F., Werkhoven, P.J. *Vibro-tactile and visual asynchronies: Sensitivity and consistency*. 33 (2004), 103–111.