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CanHap 501: Learning Haptic UX Design in Remote Teams

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***Abstract*— We describe the graduate-level CanHap 501 (`wiki.canhaptics.ca`) course, an introduction to the inception, creation and evaluation of haptic and multimodal human-computer interfaces. The course covers perceptual and attentional foundations, and emphasizes control and/or display of computed sensations and environments through haptic devices to users' sense of touch for the purpose of haptic communication—e.g., signalling, social and affective touch, and sharing of control between humans and smart systems.**

I. Introduction

As an emerging trans-Canada haptics network, we wanted to leverage our collective expertise to train and network a new cohort of *hapticians*—haptics researchers and practitioners—with a focus on haptics user experience (UX) design, supported by relevant engineering and psychology concepts, and opportunities for cross-fertilization of ideas, methods, and practices. CanHap 501's origins were in a UBC course on rapid haptic design ideation (sketching), itself developed in collaboration with Camille Mousette; and in the WHC'17 Student Innovation Challenge [1]. This is a hands-on approach. We embraced the opportunity to tackle the question of how haptic experiences can be developed and shared effectively by a critical mass of distributed teams.

II. Students, Platforms, Scope and Project

In Winter 2021, we enrolled 17 haptics-focused grad students from 5 institutions, with engineering, computer science and human-computer interaction backgrounds. Four students joined from other continents due to visa obstacles. Since remote teaching is the norm due to COVID-19, barriers to multi-institutional teaching were lowered; but without access to workshops, hardware prototyping was infeasible. To share experiences, devices had to match, and we wanted to expose our students to the advanced multimodal design opportunities of force-feedback. We collaborated with Montreal's Haply Robotics to provide a second-generation development kit, the Haply 2DIY (`2diy.haply.co`) to each student.

Lectures and lab activities introduced fundamentals: machine haptics (force feedback, PID control), human haptics (perception, attention, sensorimotor control), and experience design process. These concepts were applied to a semester-long team project of designing a haptic experience, loosely based on the WHC'17 SIC [1], emphasizing force feedback in a multimodal context. To encourage cross-lab networking and idea pollination, each team had to represent ≥ 2 institutions and had 2 faculty co-mentors. Students proposed and pursued projects on anxiety therapy, handwriting training, data graph hapticization, and music notation display.

III. A Cross-Institution Teaching Environment

No one institution could provide access to remote-teaching tools. We used Wiki.js for static content, and organized course materials on an embedded "dashboard". Textual communication took place through Discord. We held lectures synchronously on Zoom, stored lecture recordings, student rosters and grades on an institutional NextCloud account to comply with privacy, and non-sensitive materials, i.e., slides and documents, on a Google drive. For student engagement with course readings and videos, including the superb LearnHaptics modules (`www.learnhaptics.org`), we used Perusall, in which students are automatically scored based primarily on their annotations of the material.

IV. Wins and Challenges Inspiring Research

We observed real fostering of a network among students in different locations; multiple teams are continuing their joint projects, and enthused about a seminar series. All students got to know all the instructors. The diversity of perspectives not available within a single institution led to interesting group projects, four of which are presented as works-in-progress in these proceedings. We have long struggled with not only how haptics can be taught remotely, but also how distributed design teams can work effectively. This course offered immediate experience and pointed out challenges; one student will continue to study these in her thesis.

Some infrastructure and device investment challenges were logistic and one-time; e.g., when our beyond-Canada students 2DIYs were delayed, we had to substitute other hardware. Another issue was effectively deploying the instructor team: co-mentoring projects was a huge win, but sharing of marking caused logjams. Use of a uniform haptic platform worked well when aided by Haply coaching, but did not solve everything—e.g., determining whether individuals were feeling the "right" thing, and when differences were due to hardware issues.

A post-course survey was highly encouraging, and highlighted the networking. Next time we plan a hybrid approach with physical lab "nodes" at each institution for co-located activity, using alumni as TAs for greater 1:1 support, and expanding inclusion to arts and social science.

References

[1] H. Seifi, M. Chun, C. Gallacher, O. Schneider, and K. MacLean, "How do novice hapticians design? a case study in creating haptic learning environments," *IEEE Trans Haptics*, vol. 13, no. 4, pp. 791–805, 2020.

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