

## New & Ongoing Projects

### Sensory Perception and Interaction Lab (SPIN)

<http://www.cs.ubc.ca/labs/spin/>

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#### PROJECTS:

<b>1</b>	<b>Supporting novice haptic designers with tools and/or ecosystem</b>	<b>2</b>
<b>2</b>	<b>Haptic guidance of movement – rehabilitation or skill acquisition</b>	<b>2</b>
<b>3</b>	<b>The role of haptics in conceptual learning</b>	<b>3</b>
<b>4</b>	<b>How haptics impacts learning of complex motor skills:</b> Learning metrics and curriculum validation for haptic augmentation of endoscopy simulation	<b>3</b>
<b>5</b>	<b>Affective Human Robot Interaction – Calmer to CuddleBits</b>	<b>4</b>

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The projects in the following pages list positions that are potentially available, along with specific background minimally needed for success in the.

#### General requirements:

In addition, virtually all roles in the SPIN lab, particularly at graduate and postdoc level, also require:

- Solid programming capabilities
- Human computer interaction: excellent performance in undergrad-level HCI courses (UBC CPSC 344/544, CPSC 444, or equivalent) including at least course-level experience in studying users and modular prototype
- Physics: A good grasp of basic concepts.
- Comfortable with minor hardware tinkering
- Good work management, team collaboration and problem-solving skills

#### Designing for People Research Cluster (<https://dfp.ubc.ca>)

All students in SPIN lab working with MacLean will be full members of interdisciplinary, pan-UBC Designing for People (DFP) research cluster and, for grad students, the CREATE graduate training program, and should review the information at its website as well.

## 1 Supporting novice haptic designers with tools and/or ecosystem

**Synopsis:** Our lab has been spearheading international efforts to advance a design ecosystem in which novice haptic designers can work effectively. By studying designers, building tools and observing their use in a range of environments, we've developed frameworks that continue to inspire new tools.

Some of this work can be seen in projects on “supporting haptic designers”, as well as [many of the specific tools](#) we've built and shared. One well known tool is the [Haptipedia Project](#) ([www.haptipedia.org](http://www.haptipedia.org)).

This work could go in a variety of directions: for example,

- Tools and guidelines for design in specific applications
- Use of advanced computational techniques to support design environments (e.g., programming languages)
- Construction and study of the impact of a design ecosystem (repository of tools curated around a learning framework that supports stage-specific guidance and support).

### Opportunities:

- *Graduate student*
- *or postdoc*

Requires:

- Familiarity with haptic technology, and some experience in application and interaction design using it
- For PL direction, background and aptitude in programming languages

## 2 Haptic guidance of movement – rehabilitation or skill acquisition

**Synopsis:** Building on a deep background in [the design, perception and evaluation of tactile signaling and motion guidance in attentionally challenging environments](#), we're embarking on a new collaboration with researchers in UBC Kinesiology to detect subtle movement in realtime and, through haptics, give guiding cues in realtime. The innovative goal here is to develop solutions that can work outside a therapists' lab, allowing the patient to access guidance when out and about, and the therapist to collect relevant activity data with non-intrusive sensing.

Possible directions include:

- Vision system: Build on existing cutting-edge realtime vision detection (with [Helge Rhodin](#), UBC Computer Science) to get immediate, nuanced movement information relevant for therapeutic feedback to be provided in realtime.
- Design new super-flexible wearable tactile displays and sensors, both to augment the sensing of the patient's movement and to provide a localized channel for providing movement triggers or feedback to the patient.
- Develop the actual protocol for realtime movement feedback for rehabilitation therapy (with Kinesiology collaboration) and evaluate perceptibility and efficacy. First step is in the lab, later step we go outside.

### Opportunities:

- *Up to three graduate student or postdocs:*

Requires:

- Direction 1: background in computational vision
- Direction 2: background in wearable sensing and tactile feedback and perception
- Direction 3: excellent user evaluation skills, rehab exposure a plus.

### 3 The role of haptics in conceptual learning

**Synopsis:** This project aims to learn whether the embodied, tangible aspects of an engaged haptic (force feedback) experience can contribute to learning of physical concepts, such as force-motion relationships as taught in high school physics courses.

This project builds on years of past work in our lab in both [studying haptics in learning technology](#), and developing [novel haptic devices to support learning](#) and other objectives in the form of *haptic digital manipulatives*.

A key philosophy underlying our approach is that learners who are not expert programmers will be distracted by the arduous task of constructing haptic simulations. Instead, we envision natural, “free roam” interfaces where students can sketch environments, interact with them, ask questions and through informal physical / visual experimentation, answer them.

#### Opportunities:

- **Graduate student or postdoc**

Requires:

- Programming: Strong and extendable programming abilities.
- Demonstrated creativity and skill in interface design.
- Interest in education research

### 4 How haptics impacts learning of complex motor skills:

Learning metrics and curriculum validation for haptic augmentation of endoscopy simulation

**Synopsis:** This project is a collaboration with a company which has developed a novel endoscopy simulation device that features both haptic feedback and high quality, personalizable physical patient models. Objectives are to identify the value and role of haptic feedback in skill acquisition, metrics for measuring both relevant fidelity and learning, and curriculum validation. The project is a partnership between the company, MacLean, and clinical collaborators at Vancouver General Hospital who are involved with surgical training. It presents an opportunity for exceptional involvement in highly translatable research that can also lead to landmark findings in physical simulation training in real clinical environments.

This project is ready for a quick start, as early as Summer 2020. We’re looking especially for individuals with relevant training in one or more of surgical simulation, motor and procedural learning, haptic feedback design and evaluation, human computer interaction design process.

#### Opportunities for two positions:

- **Graduate student (well prepared PhD) or Postdoc**

Requires:

- Background in one or more of surgical simulation, motor and procedural learning, haptic feedback design and evaluation, human computer interaction design process.
- Demonstrated skill in research methods (design, evaluation) and ability to produce publishable papers

- **Research Associate – 3 year appointment**

Requires:

- Relevant training in one or more of surgical simulation, motor and procedural learning, haptic feedback design and evaluation, human computer interaction design process.
- Ideally have completed at least a Masters in relevant area, have experience working in clinical environments, and be prepared for project management responsibilities.

## 5 Affective Human Robot Interaction – Calmer to CuddleBits

**Background:** SPIN lab has been working for many years on affective (emotion) communication through touch in the context of touch-centric human-robot interaction. Early on, we had an important finding that certain kinds of haptic stimuli, such as breathing motion of a held object, can have a striking impact on the holder's emotional state. Several projects derived out of this, including:

- [CuddleBits](#), simple 1-DF versions of earlier, [more complex machines](#) that we use for rapid iteration on behavior elements.
- [Touch sensing](#) is provided with a custom sensors, where we are currently innovating on recognition algorithms.
- [Calmer](#), a bed for premature infants that replicates mothers' breathing movement and heart rate for a protective impact on infant brain development, while meantime a design challenge for introduction into a sensitive environment due to concerns about maternal replacement.
- Emotion modeling (in preparation)

Next steps in this work can include:

- Advanced methods for detecting user emotion through touch and adapting robot behavior based on this channel.
- Delving into the question of how people, particularly caregivers (including parents of young children, or adult children of aging parents), regard technology in the context of the care of their loved ones, and the relation of 'robotness' and other factors to this.
- Design and study impact of active, emotionally responsive haptic objects on mental health and behavior, in a range of contexts including undergraduate life, pediatric waiting rooms, grade school classrooms.

### Opportunities:

- *Grad or postdoc:* Interaction design and experiment support
- *Grad or postdoc:* Affective modeling and detection through touch and other modalities