

# Do-It-Yourself Haptics: A Practical Introduction to Haptics for Consumer Electronics

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## Abstract

What was once accomplished by directly interacting with physically embodied objects, tools and controls is now increasingly performed through abstract, intangible interfaces. The distinct edges, textures and clicks of physical buttons are, for example, gradually being replaced by the blank feel of a touchscreen, with only audio-visual feedback remaining to guide actions. While flexible, these interfaces impose greater attentional demands and do not fully exploit the richness of the sense of touch. Haptic feedback promises to restore natural, direct and responsive interaction to these digital interfaces and to thereby improve their physical esthetics and reduce their reliance on the overloaded senses of vision and audition.

This tutorial assumes no knowledge of haptics and aims not only to provide a broad overview of the topic to consumer electronics practitioners, but also to engage you in a dialogue about the challenges and benefits of integrating this technology in their products. The tutorial will introduce you to current uses of haptics in consumer electronics, the basics of haptic perception in humans, the design and effective use of simple haptic interfaces, and cutting edge haptic interfaces being explored in research labs around the world. It will provide a solid basis for consumer electronics professionals to further investigate this important emerging technology.

## Detailed outline – 2 hours

### 1) Introduction – 15 minutes

Introduce haptic feedback and discuss the current state of haptics in consumer electronics; consider the value of restoring designed touch to interactions with mobile devices and other electronic devices.

- What is haptics?
- How is haptics currently used in CE?
- What more can haptics bring to CE?

**Teaser questions:** *How is haptics perceived in the CE community? What is preventing haptics from being more widely adopted?*

## 2) Haptic perception in humans – 20 minutes

Present the basics of haptic and multimodal perception in humans, with a focus on the impact of perceptual capabilities on the design of haptic hardware and effective haptic interactions.

- What types of sensors mediate the human sense of touch?
- What should designers know about haptic and multimodal perception?
- How can this information be used to design better haptic interfaces?

**Teaser Questions:** *How important is the sense of touch in your daily life today versus 10 years ago – or more? Are electronic interfaces fully exploiting our haptic senses?*

## 3) Do-it-yourself haptics (hardware and interaction) – 30 minutes

Overview simple force feedback and vibrotactile haptic hardware and the design of effective interaction techniques that make use of the affordances of these interfaces; work through examples such as the use of active rotary controllers for media control and vibrotactile displays for haptic icon presentation.

- How can simple haptic hardware be designed and experimented with?
- How can effective haptic interaction techniques be designed and evaluated?
- How can user-centered design and low-fidelity prototyping improve the quality of haptic interfaces?

**Teaser Questions:** *Are the skills necessary to integrate haptics available in the CE community? What kind of learning supports would you like to see, e.g. from the academic community?*

## 4) Emerging haptic technologies – 30 minutes

Take a swift journey through recent advances in haptic interfaces and speculate about the future of haptic technologies in CE.

- High-performance vibrotactile actuators, distributed tactile displays, force-feedback interfaces and other emerging haptic technologies.
- Applications of novel haptic interfaces for gaming, rehabilitation, mobile interaction, surgical simulation and other areas.

**Teaser Questions:** *How could these technologies be applied to CE? What direction should haptic research take to address the needs of CE?*

## 5) Conclusion – 5 minutes

Summarize the tutorial's key messages, and reiterate the importance of haptics in consumer electronics. The audience will be directed to additional resources such as journals and conferences on the topic.

## Biographies

**Vincent Levesque** is a postdoctoral fellow in the Computer Science Department at the University of British Columbia (Vancouver, Canada). He received a B.Eng. in computer engineering (2000), and a M.Eng. (2003) and PhD (2009) in electrical engineering from McGill University (Montreal, Canada). His research interests include tactile displays and rendering, applications of haptics for persons with visual impairments, and, more recently, interaction design with novel haptic interfaces. He is the recipient of several awards including a Best Paper Award at the 2007 IEEE World Haptics Conference for his work on refreshable Braille, the Best Demonstration Award at the 2008 Haptics Symposium for his work on dynamic tactile graphics, and the Best Reviewer Award at the 2010 Haptics Symposium. He holds a Postdoctoral Fellowship from the National Science and Engineering Research Council of Canada.

**Karon MacLean** is Professor of Computer Science at the University of British Columbia, Canada with an associate appointment in Mechanical Engineering. She has a B.Sc. in Biology and Mechanical Engineering from Stanford (1986) and a M.Sc. and Ph.D. in Mechanical Engineering from MIT (1996), with experience as robotics engineer (Center for Engineering Design, Univ. of Utah), research scientist (Interval Research, Palo Alto) and interface design consultant. She has been at UBC since 2000. Her interests in ubiquitous haptic and multimodal interfaces bring together robotics, interaction and affect design and psychology with the goal of restoring physicality to embedded computation, and has been recently supported by Nokia, Immersion, Nissan and others. She uses touch feedback as part of a multisensory HCI toolbox in the context of real design problems like mobile devices and automobile controls, to leverage new design techniques and define studies of multimodal perception and attention. Charles A. McDowell Award, 2008; Assoc Editor of IEEE Transactions on Haptics (founding); co-chair of the 2010 and 2012 IEEE Haptics Symposium.

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### More detail in particular areas

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