



1 Let your body move: electrical muscle stimuli as haptic

Workshops and Tutorials will take place on Monday, June 22, 2015 during the IEEE World Conference 2015 in Chicago, USA.

General Information:

Website: <http://haptics.levelup.webfactional.com/>

Type of Activity:

Please select:

Tutorial

Proposed Duration:

Please select:

Full day

Preferred time:

Please select:

Morning

2 ABSTRACT

In this tutorial we present electrical-muscle stimulation in a hands-on experience. We provide a ready-to-use device and tool kit, which allows quick prototyping, to combine the benefits of haptics with mobility. Furthermore, we provide a mobile app to control easily the device remotely.

We expect that the synergies between different researchers will generate new interesting applications around electrical muscle stimulation in Haptics. The one-day tutorial will provide a space for brainstorming ideas, developing prototypes and showcasing them at the interactivity session; thus, exposing the work to the Haptics community. The participants will learn how operate EMS devices and explore their interactive potential.

3 AUDIENCE

The tutorial has the educational objective to exchange knowledge about functional muscle stimulation in the context of HCI. The participants should learn how to handle the technology and get experience by using it. They explore the capabilities when developing scenarios for using electrical muscle stimulation. Finally they should learn how to use electrical muscle stimulation in a simple scenario and present it to the community.

4 SPEAKERS (tentative program)

Speaker:

- Pedro Lopes
- Max Pfeiffer

Tentative Program:

Introduction	Propose and prospects of the tutorial	10 min
5 min position presentation	Introduction of the participants and presentation of the position paper	30 min
EMS- overview	Introduction of EMS Medical and safety aspects, technology, providing movements	20 min
Getting in touch with EMS	EMS-System and pads for the participants Find and control a muscle	20 min
Group division	Participants will group into teams: <ul style="list-style-type: none"> • Providing physical properties • Information transmitting • Assistive system 	10 min
Focused-brainstorming ² and paper prototyping	Group brainstorming on the group topic Paper prototyping with paper, modeling clay and pipe cleaner	20 -40 min
-Break-		
Hands-on experimentation	Each participant gets an Pose-IO bracelet Control it with Wi-Fi or Bluetooth via App	60 min
-Lunch-		
EMS- prototype scenario	Participants identify muscles for prototype Attached the device to perform movements of the scenario Perform Wizard-of-Oz scenario	60-90 min
Prototype presentation	Participants present the prototypes	30 min

5 ORGANIZERS

Insert here details of each organizer as follows

- M.Sc., **Pedro, Lopes**, Hasso Plattner Institut:

Pedro Lopes is a PhD student of Prof. Patrick Baudisch's Human Computer Interaction lab in Hasso Plattner Institut, Berlin. Pedro creates wearable interfaces that read & write directly to the user's body through our muscles [plopes.org]. These interfaces augment humans & their realities by using electrical muscle stimulation to actuate human muscles as interfaces to new virtual worlds. These works have been published at ACM CHI, UIST and Haptics. Recently, Pedro has been awarded the CHI 2015 Best Paper award for Affordande++, a work on electrical muscle stimulation that provides users with a haptic understanding of an objects' affordance. Pedro is a believer on the unification of art and research, and he often gives talks about it [BodyControlled, Campus Party 2013, A MAZE 2014]. Makes and writes music using turntables [in eitr]. Enjoys writing about music [in jazz.pt magazine] and tech [as digital content editor at ACM XRDS].

- M.Sc. , **Max, Pfeiffer**, University of Hannover:

Max Pfeiffer is a researcher in the Human-Computer Interaction Group at the University of Hannover. Before joining that group in 2012 he worked for two years in the Software Engineering, esp. Mobile Applications Group at the paluno The Ruhr Institute for Software Technology as a researcher. There he worked on and led a cloud computing enabling project with Deutsche Telekom Innovation Laboratories. He reviewed for conferences such as ECSA, TEI, MUM, MobileHCI, Augmented Human, NodicCHI and CHI. He attended to ECSA, MobileHCI, UbiComp, Augmented Human and CHI and presented his work. At ECSA 2011 he worked in the Back Office (finance team), was student volunteer at the MobileCHI 2013 and chaired a session at Augmented Human 2015. His research interests are in haptics feedback, computer support systems for guidance and for learning movements and HCI in sports. In his research he investigates novel interaction technique for guidance and simulating object properties in 3D, virtual, mix- and augmented realty environments. In one of the major approaches he uses electrical muscle stimulation to applying tactile, haptic and force feedback to users. His work runs thought whole reached circle form building hard- and software portioning, evaluation in server studies and publications.

- Prof. Dr., **Michael, Rohs**, University of Hannover:

Michael is a Professor of Human-Computer Interaction in the Faculty of Electrical Engineering and Computer Science at the Leibniz Universität Hannover, Germany. His primary research interests are in mobile human-computer interaction, mobile interactive media, and pervasive computing. Michael's work focuses on novel interaction techniques for mobile devices, applications of computer vision techniques in mobile HCI, the usage of sensors for mobile interactions, and the integration of physical and virtual resources in the user's environment.



Michael received a Diplom in Computer Science from the Technische Universität Darmstadt, Germany, a Master's degree in Computer Science from the University of Colorado at Boulder, USA, and a Ph.D. in Computer Science from ETH Zurich, Switzerland. In the past, he has worked as a research assistant in the Distributed Systems Group at ETH Zurich and as a senior research scientist at Deutsche Telekom Laboratories, Technischen Universität Berlin, Germany.

- Prof. Dr., **Patrick Baudisch**, Hasso Plattner Institut:

Patrick Baudisch is a professor in Computer Science at Hasso Plattner Institute at Potsdam University and chair of the Human Computer Interaction Lab. His research focuses on natural user interfaces and interactive devices, including miniature mobile devices, touch input, interactive floors and rooms, and most recently interactive fabrication. Previously, Patrick Baudisch worked as a research scientist in the Adaptive Systems and Interaction Research Group at Microsoft Research and at Xerox PARC. He holds a PhD in Computer Science from Darmstadt University of Technology, Germany. He was inducted into the CHI Academy in 2013 and has been an ACM distinguished scientist since 2014.

6 CALL FOR CONTRIBUTIONS (OPTIONAL, Compulsory for Open Workshop)

Haptic feedback allows leveraging other faculties such as *proprioception* instead of using the visual sense, which is often overloaded with traditional UIs. However, most haptic technologies have been away from the current trend in Human-Computer Interaction (HCI) which is miniaturization (e.g., mobile, wearable). Therefore haptic techniques, such as force feedback, tend to stay inside labs. In fact, most haptic devices resist miniaturization because they require physical motors and mechanics, which do not scale down easily.

Researchers have proposed miniaturizing and simplifying haptic devices by using electrical-muscle stimulation as to actuate the muscles directly, rather than actuating through mechanics. Electrical muscle stimulation (EMS) uses a small current to elicit action on the motor fibers/nerves, causing an involuntary contraction on the user's body.

This enables mobile haptic devices capable of driving realistic forces, such as Muscle-Propelled Force Feedback, which fits the back of a mobile phone or in a wearable device. Furthermore, this technology has been used to create a new eyes-free interactive channel for both input and output-proprioceptive interaction, at the size of a wearable bracelet. Moreover, EMS has been used to extend the affordance of everyday object by actuating the user as to suggest the correct way to manipulate these objects. Also EMS has been applied to: teach a new skill such as playing a musical instrument, feeling virtual objects, and navigation support. For more realistic interaction different objects properties were simulated for interaction with a wearable system and for supporting pointing tasks. Furthermore EMS has been used in a pedestrian navigation scenario to bypass cognitive interpretation and directly manipulate the human locomotion system.

In this tutorial we present electrical-muscle stimulation in a hands-on experience. We provide a ready-to-use device and toolkit, which allows quick prototyping. The toolkit



combines the benefits of haptics with mobility. Furthermore, we provide a mobile app to easily control the device remotely.

We expect that the synergies between different researchers will generate new interesting applications around electrical muscle stimulation in haptics. The one-day tutorial will provide a space for brainstorming ideas, developing prototypes, and showcasing them at the interactivity session; thus, exposing the work to the Haptics community. The participants will learn how to operate EMS devices and explore their creative potential.