

Proceedings of the 3rd European Tangible Interaction Studio (ETIS) 2017

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MOTIVATION

Tangible interaction is a research field addressing areas at the border of the physical and the digital. Nowadays many researchers, designers, developers and artists work in this area and a vast range of products and applications are designed and produced accordingly. Besides, many research projects are funded through research funds at a European and international level. The *European Tangible Interaction Studio (ETIS)* is an initiative to give the possibility mainly to PhD students, but also practitioners, such as designers, and engineers, to present their work and receive fruitful feedback from other participants. ETIS includes also invited talks by renowned researchers from Academia and professionals from Industry. Furthermore, prototyping sessions (called workshops) are being organized in order to train ETIS participants in creating applications on their own in the general field of tangible interaction.

ETIS 2017 took place in 18-23 June 2017 in two venues: at Luxembourg Institute of Science and Technology (LIST) (18-22 June) and at Human Computer Interaction and Interactive Technologies Lab in Saarbrücken, Germany (23 June). ETIS is very relevant to Luxembourg and LIST in the framework of its research stream on Ambient Intelligence and Cyber-Physical Social Systems. The research connects interactive spaces with adaptive systems and human skills through multi-user natural interaction, while tangible interaction plays a key role.

The 3rd *European Tangible Interaction Studio* is a follow-up Studio of the previous *European Tangible Interaction Studio*, which took place in Fribourg (Switzerland), 25-29 January, 2016. The very first version was the *French German Tangible Interaction Studio*, held in Bidart (France) during summer 2013. ETIS is a collaboration between the German working group “Be-greifbare Interaktion” and the French working group TANGINT/FR. The German working group “Be-greifbare Interaktion” is a working group that was founded in 2008 at TEI conference (Tangible and Embedded Interaction) in Bonn and in the meantime is an official working group of the technical committee of Human-Computer Interaction in the German Informatics Society (GI). TANGINT/FR was founded by AFIHM (Association Francophone d’Interaction Homme-Machine) in 2011 under the initiative of Professor Dr. Nadine Couture and Dr. Guillaume Rivière.

GOALS OF THE STUDIO

The goal of ETIS, in general, is to gather young European researchers in tangible interaction, to get them in touch with internationally renowned researchers and to establish networks for their future. This summer school is a unique opportunity to train in the field of tangible interaction and to discuss ETIS participants’ research with professors and other senior researchers. The Studio includes voices from enterprises and private research institutions and welcomes researchers with different backgrounds from both academic and applied research. We aimed to provide participants with useful insights both for their further research and any applied research possibilities in order to bring tangible interaction principles out of the lab, in the everyday use.

ETIS Studio 2017 brings together 36 participants. 13 participants are from Luxembourg, 10 from France, 8 from Germany, while there are also 2 participants from the U.K., 2 from Switzerland, and 1 from the USA.

ETIS STUDIO TOPICS

Topics of interest of ETIS 2017 included, but were not limited to:

- Research in tangible interaction, including prototyping and digital fabrication, wearables, Internet of Things, 3D interfaces, mixed and augmented reality.
- Theoretical foundations, frameworks, and concepts of TUI;
- Design implications for tangible interaction (guidelines, methods, lessons learned);
- Technologies, tools and toolkits for TUI (e.g. speech/gesture-based interfaces, haptic feedback);
- Case studies (method, design, results) with TUI;
- Applications and evaluation of tangible interaction in different domains (education, health, entertainment, art, cooperative work, assessment);
- Tangible interaction for various target groups (children, elderly, people with disabilities).

INVITED SPEAKERS

In ETIS 2017 there are four invited speakers who are presented here in alphabetical order.

1st Invited Speaker: Dr. Martin Hachet (INRIA, Bordeaux)

Title: Creating, learning, and meditating; a trip in tangible hybrid spaces.

Abstract: Martin Hachet presented a set of recent works conducted at the Potioc lab. This includes approaches that mix physical and digital interaction for artistic creation. He also discussed how the new hybrid tools his team has designed recently may enhance the understanding of complex phenomena (e.g. for brain activities and wave optics). Finally, he presented the *Introspectibles* that are tangible and augmented objects dedicated at introspection. Thus he showed how such interfaces can open the way to mindfulness.

2nd Invited Speaker: Dr. Wilko Heuten (OFFIS – Institute for Information Technology)

Title: How can tangible interaction increase safety and well-being?

Abstract: Interactive systems aiming at improving health, changing behavior, providing assistance to people with functional decline, or helping to reduce workload in someone's job need to integrate seamlessly into the user's life. In order to avoid obtrusiveness and distraction from primary tasks, they should offer their support in opportune moments, only when necessary or on demand. Tangible interfaces and their physical appearances offer new possibilities for such integration and in the same time provide a high affordance and usability if designed appropriately. This talk presented examples of and reveals opportunities for tangible interaction based on research projects in the area of safety, well-being and social interaction.

3rd Invited Speaker: Dr. Roderick McCall (Luxembourg Institute of Science and Technology)

Title: Mixing Realities: From the Real to Virtual and Back Again?

Abstract: Mixed reality gives us the opportunity to move beyond the “real vs virtual” divide and start to explore the relationship between the two worlds. This talk explored some theoretical backgrounds about space and place, and more recent work on blending the real and virtual worlds which we now inhabit.

4th Invited Speaker: Prof. Albrecht Schmidt (University of Stuttgart)

Title: Prototyping Smart Objects, Tangible Interaction, and Physical User Interface.

Abstract: The Internet of Things (IoT) is a trend that is typically related to automation, however many of the smart objects that are envisioned and predicted are things humans interact with. In this talk we looked at the basic concepts and technologies driving the internet of things and how this can create a new area in interactive systems. The focus was on approaches and tools that help to create functional prototype of embedded user interfaces and of interactive smart objects.

He discussed the challenges when moving from screen-based interfaces to interaction in physical space. With examples from his lab, he showed how interaction can be embedded and made the argument for “Understanding through Making”.

5th Invited Speaker: Dr. Anusha Withana

Title: Embedded Sensing and Actuation for Expressive Tangible Interactions.

Abstract: The expressivity of tangible interfaces can be significantly improved by embedding sensing and actuation systems that enable diverse interaction modalities. However, ubiquitous computing devices, particularly physical and tangible interfaces are constrained by their form-factor, available processing resources and battery power. Hence, designers face challenges in embedding commonly available sensing/actuation technologies in tangible form-factors. Using examples from gestural interfaces and body base haptic output, this talk presented advance technologies that utilize perceptual phenomena, rudimentary physics and bio-mimicry to create highly expressive interfaces within constraints of tangible interfaces.

DEMOS

Three demos from the Industry in Luxembourg are presented in ETIS 2017. Short abstracts can be found here:

1st Demo: Olivier Raulot (iNUI Studio)

Abstract: He presented two offerings in two different markets that *iNUI Studio* has developed:

Digital Signage: i) Interactive semi-outdoor displays powered by AIRxTOUCH™: the only technology working behind any type of glass and in any light condition and ii) a Content Management Software for digital signage named FlyFolder.

Interactive Touch Table: The Surface Hub Solutions: delivering digitized and interactive customer journey applications to banks, retailers, real estate agencies and others. The touch table's hardware is based on Microsoft's Surface Hub, the premium interactive display.

2nd Demo: Dany Lockman (CLK Constructions)

Abstract: This demo showed how the company *CLK Constructions* offers the possibility to their clients to visit their future house in a matter of days after the signature of a construction contract.

The people in the audience were given the possibility to try the solution and give their opinion and/or advice for improvements.

The solution uses the HTC Vive headset and a game engine to build the Virtual Experience. Moreover, future developments were presented, such as client interactivity, Building Integration Modelling (BIM) integration, and the use of augmented reality (AR) glasses.

3rd Demo: Pouyan Ziafati, Aida Nazarihorram (LuxAI)

Abstract: *LuxAI* uses the latest advancements in Artificial Intelligence and robot-therapy in building social robots to assist people. The team presented the QTrobot, their first toddler-like product, which is a socially engaging and interactive robot. It can teach science and positive social behaviours to children and assist older people in post stroke rehabilitation, among its other applications.

PAPER CONTRIBUTIONS

The program of ETIS consists of seven invited papers which we thematically included in three sessions: *Peripheral Tangible Interaction*, *Tangible Interaction Techniques*, and *Design of Tangible Systems*. In the session of Peripheral Tangible Interaction, Thomas Pietrzak, Gilles Bailly and Sylvain Malacria presented how computer peripherals can enable new interactions, as nowadays these peripherals became everyday objects. In the same session, Maxime Daniel talked about how perceptible artefacts (e.g., shape-changing, color-changing) influence the effectiveness of ambient interfaces and studied ambient tangible interfaces for shifting energy supply with laptops in the workplace. In the second session about Tangible Interaction Techniques, Lou Schwartz and Thibaud Latour talked about iconic or symbolic representation of tangible objects and their characteristics. Philippe Giraudeau examined the understanding of the cognitive science frameworks related to their project on collaborative learning with reality-based interaction. Last but not least, Dominik Madden presented a few multiscreen patterns and interactions across the borders of devices. In the third and last session, Design of Tangible Systems, Alexandre Gomes de Siqueira, Brygg Ullmer and Mark Delarosa presented fabrication techniques and commercial examples of a class of tangibles embodied as cylinders, wheels, or knobs that can function with mass-market multi-touch devices. Torben Wallbaum, Andrii Matviienko, Wilko Heuten and Susanne Boll discussed what we can learn from the failures of tangible systems and the challenges raised during the design of tangible systems. In the same session, Stephanie Rey described a participative event, involving both visitors and museum actors during a three-day hackathon in order to create digital artefacts for museums, among them tangible experiences.

WORKSHOPS

Six 2/3-hour workshops took place in ETIS 2017, the abstracts of which are presented here:

Workshop 1: MakeMe, CodeMe, ConnectUs: Learning digital fluency through tangible Magic Cubes (Zuzanna Lechelt, Yvonne Rogers, Nicolai Marquardt, Frederik Brudy)

Abstract: Tangible physical computing interfaces provide much scope for teaching abstract digital fluency concepts in an engaging and playful way. However, questions remain as to how both the form factor and the corresponding task types of such interfaces can be best designed to support learning.

In this hands-on workshop, participants explored how digital fluency topics might be taught through making, discovery learning and coding by interacting with the tangible Magic Cubes toolkit. The workshop culminated in a discussion of how tangible toolkits for learning can be better designed to encourage collaborative and engaging learning experiences.

Workshop 2: Tangible Interaction with the Internet of Things (Leonardo Angelini, Nadine Couture, Omar Abou Khaled, Elena Mugellini)

In the Internet of Things (IoT) era, more and more everyday objects are able to collect information and share it with other connected objects and people. Most IoT objects allow users to access this information through smartphone or web apps, requiring users to take out their phone from their pocket even for the simplest action, such as switching on a light. The purpose of the workshop is understanding whether tangible interfaces can provide better representations and controls for IoT object parameters and functions, with a special focus on peculiarities of IoT, such as control and representation of activity status, connectivity, information acquisition and sharing. To this purpose, the workshop discussed how tangible interaction properties can be exploited for IoT object design, throughout different phases of idea generation, interaction sketching and paper prototyping.

Workshop 3: Prototyping Connected Tangible Interactions with Kniwwelino (Christian Moll, Johannes Hermen, Valérie Maquil, Henrique Rangel, John-Nathan Hill)

This workshop introduced Kniwwelino, a new Arduino compatible microcontroller platform, supporting the electronic prototyping of interactive and connected objects. Kniwwelino provides sensors and actuators encapsulated in Wifi functionality, made easily accessible through a specially developed library. The workshop is designed as continuation of workshop 2, dedicated to the actual implementation of the previously elaborated ideas. Aim is to explore the possibilities and limitations of the platform for prototyping tangible interaction enabled IoT projects.

Workshop 4: Tangible User Interfaces Characterization (TUIC) (Regina Ticona-Herrera, Guillaume Rivière, Nadine Couture and Stéphanie Fleck)

This workshop addressed the question “What are the characteristics of a Tangible User Interface”? The workshop aimed at answering this question in four parts. First, this question asks researchers/developers/students/innovators to think about the challenges tackled by the development of a TUI and about how they can describe a TUI. Second, it asks the tangible artefacts designed as part of a TUI. Third, it asks the relevant constraints in the TUI development related to the user and the system. Finally, it asks the origins of the TUI related to the breaking elements and inspiration sources. The goal of this workshop was to provide a set of characteristics that participants will use to describe some TUIs of the literature.

Workshop 5: Hands on Soft Prototyping and its Applications in Educational Practices (Adriana Cabrera)

This workshop presented an overview of the activities in digital fabrication, soft materials and sustainable production in Open Labs and university practices. During the workshop participants explored different soft materials thinking in the possibilities of application and how to introduce interactivity and ways of prototyping from a material research point of view.

Workshop 6: Personalized User Interfaces with Printed Electronics (Anusha Withana, Aditya Nittala, Jürgen Steimle)

Recent advances in printed electronics have enabled the creation and fabrication of thin, flexible and customizable physical user interfaces. The goal of this workshop is to acquire basic conceptual and practical skills in developing physical user interfaces with printed electronics for interactive devices and objects. The workshop covered personalized digital design of printed electronics, basics of different sensor types and actuators, and prototyping of printed electronics with conductive inkjet printing.

ORGANIZATION

Here we present the local organization committee, the steering committee of ETIS, as well the program committee, which peer-reviewed the ETIS submissions and thus guaranteed the quality of the contributions.

Organization Committee

- Dr. Dimitra Anastasiou (LIST, Luxembourg)
- Dr. Valérie Maquil (LIST, Luxembourg)
- Prof. Jürgen Steimle (Saarland University)

Steering Committee

- Prof. Nadine Couture (ESTIA Recherche, LaBRI)
- Prof. Elena Mugellini (HES-SO, HumanTech)
- Prof. Jens Geelhaar (Bauhaus Univ. Weimar)

Program Committee

- Mr. Leonardo Angelini (HES-SO, HumanTech)
- Dr. Marius Brade (Fachhochschule Dresden)
- Prof. Nadine Couture (ESTIA, Bidart)
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- Dr. Thibaud Latour (LIST, Luxembourg)
- Dr. Sophie Lepreux (LAMIH, Valenciennes)
- Prof. Elena Mugellini (Univ. of Western Switzerland)
- Dr. Eric Ras (LIST, Luxembourg)
- Dr. Guillaume Rivière (ESTIA, Bidart)
- Prof. Albrecht Schmidt (Univ. Stuttgart)
- Prof. Jürgen Steimle (Saarland University)

BIOGRAPHIES OF THE EDITORS

Dimitra Anastasiou is an R&T associate at LIST and she is currently working on a Marie Curie Individual Fellowship

project (ranked 9 out of 1335 proposals) with the title “Gestures in Tangible User Interfaces”. From 2014 to 2015 she worked at the DFG project *SOCIAL* at the University of Oldenburg, Germany. She finished her PhD in 2010 at Saarland University, Germany in the domain of “Machine Translation”. After her PhD, she worked as a post-doc in the project “Centre for Next Generation Localisation” at the University of Limerick, Ireland. From 2011-2012 she worked on the project “SFB/TR8 Spatial Cognition” at the University of Bremen, Germany. She has 7 years teaching experience and she has organized 6 workshops at international conferences. She is member of the working group “Be-greifbare Interaktion” since January 2016.

Valérie Maquil is an R&T Associate at LIST in the research group Multi-User Natural Interaction of the IT for Innovative Services Department. She holds a PhD in Computer Science from Vienna University of Technology, Austria (completed in 2010). Her current research focus is on Tangible User Interfaces, Human Computer Interaction, User Centric Design. In the past 10 years, she has worked on many EU (FP6, Interreg, Erasmus+, H2020) and national (FNR PSP, RDI) projects, all involving issues related with the design, implementation, and evaluation of TUIs in the context of collaborative problem solving, collaborative design, or collaborative decision making. Valérie Maquil has published 1 book (book version of PhD thesis), 5 peer-reviewed journal publications, and 22 peer-reviewed conference publications. She is active in many scientific communities related to tangible interaction. She is member of the steering committee of the Fachgruppe “Be-Greifbare Interaction”, member of the AFIHM working group TANGINT/FR, and member of the program committee of TEI (2013-2016).

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