



# INTUITIVE

## INnovative Network for Training in ToUch InteractIve Interfaces

Grant agreement: #861166  
Start date: 1 October 2019

H2020-MSCA-ITN-2019  
End date: 30 September 2023

### Deliverable reporting document

Deliverable no: D6.2		WP: 6
Deliverable title: First year research schools, workshops, & tutorials	Type: Report	Dissemination level: Public
Due Delivery date: 30 September 2021		Date delivered: 5 October 2021

### **Description:**

**Report on the research schools, workshops, & tutorials organized the first year of the project**

## **Deliverable text:**

### **First year research schools, workshops, & tutorials**

Shortly after the start of the Intuitive project with a kick-off meeting in Lund, the Covid-19 pandemic struck. This had a major impact on the INTUITIVE project during the start-up of the project. The restrictions in the countries of participating partners on federal and local level included shut down of workplaces, recommended or mandatory home office, and the availability of administration got limited. Furthermore, international mobility was severely limited. These effects had a major impact on the INTUITIVE project as well.

The recruitment of the ESRs that suffered from the pandemic in the form of major delays and dropouts. We could successfully recruit all but one ESR, with one candidate still to sign the contract. Therefore, we thought it advisable not to arrange any workshops or tutorials during the first year and to postpone the research school that was planned for M13. To allow participation of all members of the consortium, we arranged all the activities online. This deliverable will report these activities that were arranged for the ESRs up to M24.

### **Seminar in ethics, 27 April 2021**

A part of project plan for the ESRs is to learn about the ethics involved in science and what you need to know if you're planning to work with either humans or animals in experimental work. A few of the ESRs will work with human participants in different studies and therefore, the Ethics Advisor of the INTUITIVE project, Ulf Görman, held a tutorial where he discussed issues related to human participants and protection of personal data in research.

During the workshop, the discussion was based on his two reports on ethics (D7.1 and D7.2).

1. Ethical issues related to human participants: In an ethics check or when applying for an ethical approval at an ethics committee, a specified description of the activities involving human participants that will take place in the project is necessary to understand and evaluate the relevance, adequacy, and sufficiency of the procedures and documentation. In this description the character of each type of participation in the planned activities will have to be described including the risk and burdens for participants, the criteria for

selected participants, what is the character and type of the experimental participation, and finally information sheets and informed consent forms for each study. The overarching aspect of an ethics proposal is the informed consent. That is, the information supplied to the participants must be accurate, complete, and fully understandable to the participants. The participants must be fully aware to what they consent to and all consequences thereof.

2. Protection of personal data: In order to collect data from human participants in studies you need to know the concept of GDPR and explain how the general principles related to process personal data are followed. Ulf Görman explained how this is done and described all the subsequent articles in GDPR.

Even though just a few of the beneficiaries directly work with human participants and protection of personal data, this research is relevant for the consortium at large. Thus, all ESRs were attending this tutorial.

## **Research School 1, 3-6 May**

The first Research School took place in spring 2021. By that time, all the ESRs were able to attend and most of them had worked at least a few months in their projects. Furthermore, all tools for online communication and virtual meetings were securely established. This allowed a lively and interactive research school.

Since most of the ESRs were relatively new in the INTUITIVE project, a lot of the focus was put on introducing the different beneficiaries and partner organizations and letting the ESRs get to know each other and how their different projects are connected. The agenda of the Research School is found in appendix 1. In the following we give a short account of some activities performed during the research school. We paid attention to a mix of formats and allowing active participation of the ESRs. Overall, the ESRs found the Research School interesting, informative and an insightful experience and believed that the interaction with fellow ESRs was very useful.

### **Presentations from the Beneficiaries and Partner Organizations**

12 members of the Consortium and Partner Organizations took the opportunity to introduce themselves. During these 20-minute presentations the different Beneficiaries and Partner

Organizations explained their scientific area and how they contribute to the INTUITIVE project.

### **Workshop in paper writing**

Vincent Hayward from Actronika, Etienne Burdet from Imperial College London and Peter König from University of Osnabrück held a workshop about paper writing. The content of this workshop was to learn the difference between writing scientific papers, engineering papers and patents. How do you write efficiently and how should you structure your text and your presentations?

### **Seminars on Intellectual Property**

Gullaume Millet, who works as a patent examiner with the European Patent Office held a seminar in intellectual property together with Vincent Hayward. This seminar gave answers to questions as:

- What could you expect from a patent attorney?
- What is a patent?
- Why should you apply for a patent?
- How do you make your patent successful?

Also, Alexander Hars from Inventivio GmbH held a seminar about “protecting intellectual property with patents”. His seminar included information about:

- Why get a patent?
- Patentability
- Patent process
- Patent search
- Example patent

### **ESR contribution to the Research School**

Many points in the agenda were designed to foster active participation, contributions, and interaction from the ESRs. This was a way for the ESRs to get to know each other even though they were meeting online. One important thing for this Research School was that the ESRs should learn how the different Beneficiaries and their different projects interact with each other and how they will cooperate during their time in the INTUITIVE project. Their contribution included:

- Poster Session: The ESRS prepared a poster about a project, ongoing or old, that in some ways were connected to the work they will do in the INTUITIVE project. These posters

were presented and discussed in small groups.

- Journal Club: Four ESRs volunteered to present an article that they considered important to the INTUITIVE project.
- Speed Dating about secondments: The ESRs were divided into small groups where they discussed their upcoming secondments and how they will contribute to each other's projects.
- Individual Presentations: The ESRS presented themselves, their background, and their individual project within INTUITIVE.
- Student Presentations
- Two ESRS were selected to give a full-length presentation instead of the shorter poster presentation.

### **Invited Lecture**

Included in the Research School was also a lecture in the subject "Biological Inspired Systems" given by Gerald E. Loeb, M.D, Professor of Biomedical Engineering, University of Southern California, Los Angeles. The title of this lecture was "Intelligent Machines that Grasp Affordance". We are very happy that we could recruit such an outstanding researcher for this lecture and the response by the ESR was highly positive.

### **Workshop on neural tactile mechanisms, 21 May 2021**

21 May 2021 Henrik Jörntell from Lund University held a joint workshop with the University of Glasgow about Neural Tactile Mechanisms. The title of this workshop was "Tactile encoding and decoding in biological systems". The purpose of the workshop was to describe the many biological transduction mechanisms that could be exploited in technological implementations / electronics engineering. The workshop also covered the central mechanisms within the biological brain by which the output of these transduction processes can be decoded to create integrated precepts, for further inspiration of how biological principles could be utilized in technological design. This workshop was advertised well in advance, specifically to the ESRs, and was open to all consortium members.

## **Tutorial about how to make documents accessible, 16 June 2021**

Thorsten Schwartz from Karlsruhe Institute of Technology had a tutorial about the importance of making your published writing accessible for individuals with different disabilities and how you can do it with the tools in your word processor. He had a short presentation about this at the Research School, which was met with great interest. Specifically, by request from the ESRs, he then gave a longer tutorial about the subject.

## **The INTUITIVE project's journal club**

One of the feedbacks that came from the ESRs was that they felt that they didn't know enough about each other's topics. The INTUITIVE journal club is a way to help with this. Bi-weekly, one of the ESRs choose an educative article and upload it on the journal club repository. This is a journal club between the ESRs but the presenting ESR is free to invite PIs to participate for a better in-depth discussion. The series of meetings started on 10<sup>th</sup> September 2021 and is ongoing.

## **RoboTac 2021, 27 September 2021**

RoboTac is a highly collaborative Research Lab and every year they arrange a workshop where internationally known speakers are invited. This year the title for this workshop was "New Advances in Tactile Sensation, Interactive Perception, Control, and Learning - A Soft Robotic Perspective on Grasp, Manipulation, & HRI" and it took place 27 September. The workshop was co-organised under the INTUITIVE project and some of the PIs were invited as keynote speakers. The shortened version of the program for RoboTac is found in appendix 2.

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# INTUITIVE Research School 1

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Location: Zoom

Dates: May 3–6, 2021

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## Agenda Day 1, May 3, 2021, Zoom

- 9.00 Welcome  
*The project Coordinator opens the Research School*
- 9.15 Presentation from Lund University (H. Jörntell)  
*Brain Function in Haptics*
- 9.35 Presentation from TATA Consultancy Service (B.Rai)  
*In-Silico Modelling of Human Skin for Drug Delivery and Cosmetics Application*
- 9.55 Presentation from Actronika (V. Hayward)  
*Haptics from Theory to Applications*
- 10.15 Break**
- 10.30 Poster Session (ESRs)  
*Presentation and discussion of posters in small groups*
- 12.00 Lunch**
- 13.00 Paper Writing, Workshop (V. Hayward, E. Burdet, P. König)
- 14.00 Break**
- 14.15 Journal Club (ESRs)  
*Presentation of 4 Different Papers that the ESRs considers important for the INTUITIVE Project*
- Sofie Skårup Kristensen presenting*  
*Jörntell, H., Bengtsson, F., Geborek, P., Spanne, A., Terekhov, A. V., & Hayward, V. (2014). Article Segregation of Tactile Input Features in Neurons of the Cuneate Nucleus. 1–9.*
- Gaspar Ramoa presenting*  
*Anonymous Author(s). 2018. Classification of 2D refreshable tactile user interfaces. In Proceedings of ASSETS '21: International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '21). ACM, New York, NY, USA, 15 pages.*
- Inci Rüya Temel presenting*  
*Chortos, A., Liu, J., & Bao, Z. (2016). Pursuing prosthetic electronic skin. Nature Materials,*

15(9), 937–950.

Mark Daniel Alea presenting

Van Assche, J., & Gielen, G. (2020). Power Efficiency Comparison of Event-Driven and Fixed-Rate Signal Conversion and Compression for Biomedical Applications. *IEEE Transactions on Biomedical Circuits and Systems*, 14(4), 746–756.

## 16.15 Wrap-Up Day 1

### Agenda Day 2, May 4, 2021, Zoom

9.00 Stand-Up (ESRs)

*What did you learn yesterday*

9.15 Presentation from Karlsruhe Institute of Technology (T. Schwartz)

*Accessible Documents and Modern Ways to Get There*

9.35 Presentation from Inventivio GmbH (A. Hars)

*Protecting Intellectual Property with Patents*

9.55 Presentation from University Osnabrück (P. König)

*Embodied Cognition*

## 10.15 Break

10.30 Speed-dating Secondments (ESRs)

*The ESRs discuss their upcoming secondments in pairs, an outgoing ESR meets an ESR working at the site he/she is going to. Three slots of 30 minutes each.*

## 12.00 Lunch

13.00 Report on Secondment Plans (ESRs)

*ESRs report about the results during the speed-dating*

## 14.00 Break

14.10 PI coordinator outlook (H. Jörntell, L. Lorenzelli)

*What are the next plans for the INTUITIVE project*

## 14.50 Break

15.00 Lecture Prof. Gerald Loeb

*Intelligent Machines that Grasp Affordance*

## 16.30 Wrap-up day 2

### Agenda Day 3, May 5, 2021, Zoom

9.00 Stand-Up (ESRs)

*What did you learn yesterday*



9.15 Intellectual Property, Workshop (V. Hayward)

**10.25 Break**

10.40 Presentation from Imperial Collage (E. Burdet)  
*Extracting Haptic Information During Interaction*

11.00 Presentation from Össur (A. Sverrisson)  
*Introduction to Össur's Bionic Products*

11.20 Presentation from BMW (M. Kaboli)  
*Tactile Intelligence in Robotics and Cognitive Vehicles*

11.40 Presentation from Shadow Robot Company (R. Gudipati)  
*Why Build Robot Hands with Sense of Touch?*

**12.00 Lunch**

**ESR's Individual Presentation**

13.00 ESR1: Kaan Kesgin, ULUND

13.10 ESR2: Sofie Skårup Kristensen, ULUND

13.20 ESR3: Yerkebulan Massalim, ACA

13.30 ESR4: Shashank Mishra, UoG

13.40 ESR5: Aruna Ramasamy, ACA

**13.50 Break**

14.00 ESR6: Vincent Schmidt, UOS

14.10 ESR7: Alexis Devillard, ICL

14.20 ESR8: Mahdieh Shojaei Baghini, UoG

14.30 ESR9: Bhavani Yalagala, UoG

14.40 ESR10: Inci Rüya Temel, FBK

**14.40 Break**

15.00 ESR11: Mark Daniel Alea, KUL

15.10 ESR12: Rudra Mukherjee, UoG

15.20 ESR13: Omar Moured, KIT

15.30 ESR14: Anirvan Dutti, BMW

15.40 ESR15: Gaspar Ramoa, IVO

**15.50 Wrap-up day 3**

**Agenda Day 4, May 6, 2021, Zoom**

9.00 Stand-Up (ESRs)  
*What did you learn yesterday*

9.15 Presentation from University of Glasgow (R. Dahiya)  
*Electronic Skin*

9.35 Presentation from Fondazione Bruno Kessler (L. Lorenzelli)  
*Technologies and devices for tactile sensing at FBK*

**09.45 Break**

10.30 Student Presentation (I. Temel)  
*Design and Development of a Shear Stress Sensor Using Soft-MEMS for Slip Detection in Prosthetic Arm*

11.15 Student Presentation (M. Baghini)  
*Design and Development of Flexible Micro-magnetic Actuators for Synthetic Skin and Tactile Feedback*

**12.00 Wrap-up day 4**

# Program Robotac 2021

New Advances in Tactile Sensation, Interactive Perception, Control, and Learning  
A Soft Robotic Perspective on Grasp, Manipulation, & HRI

Organizers:

Mohsen Kaboli, BMW

Etienne Burdet ICL

Henrik Jörntell, ULUND

Tapo Bhattacharjee, Cornell University, USA

Vincent Hayward, Actronika/Sorbonne University

Opening 09:00-09:10

Mohsen Kaboli

Etienne Burdet

09:10-09:35 (20 min + 5 min Q/A)

**Vincent Hayward**

**Title:** The physical basis of haptic perception

09:35-10:00 (20 min + 5 min Q/A)

**Tansu Celikel**

**Title:** Touch in silico

10:55-10:20 (20 min + 5 min Q/A)

**Henrik Jörntell**

**Title:** The Neural Basis of Haptic Perception

10:20-10:45 (20 min + 5 min Q/A)

**Katherine Kuchenbecker**

**Title:** Sensing Tactile Contact Over Large, Soft Surfaces

10:45-11:10 (20 min + 5 min Q/A)

**Benjamin Tee**

**Title:** Materials and Skins for Intelligent Machines

11:10-11:35 (20 min + 5 min Q/A)

**Giorgio Cannata**

**Title:** Robots touching and touching robots

11:35 -12:00 (20 min + 5 min Q/A)

**Salvatore Pirozzi**

**Title:** Force/Tactile Sensor Technology for Robotic Manipulation

12:00-12:25 (20 min + 5 min Q/A)

**Firat Guder**

**Title:** Stretchable soft conductive composites for sensing force and touch

## 12:30-13:00

### Paper presentation

12:30-12:40

*Low-pass filter effects in biological neurons as a feature to facilitate representation of tactile information*

Udaya B. Rongala and Henrik Jörntell

12:40-12:50

*A Local Filtering Technique for Robot Skin Systems*

Alessandro Albin, Giorgio Cannata and Perla Maiolino

12:50-13:00

*Sensor Fusion and Multimodal Learning for Robotic Grasp Verification*

Priteshkumar Gohil, Santosh Thoduka and Paul Plöger.

13:00-13:25 (20 min + 5 min Q/A)

**Antonio Bicchi**

**Title:** Grasping with a Sense of Touch

13:25-13:50 (20 min + 5 min Q/A)

**Domenico Prattichizzo**

**Title:** Soft Manipulation with Rigid and Magnetic Constraints

13:50-14:15 (20 min + 5 min Q/A)

**Carmel Majidi**

**Title:** Soft Robots that Feel – Multimodal Sensing Skins for Soft Robot Grasping

14:15-14:40 (20 min + 5 min Q/A)

**Chris Atkeson**

**Title:** Superhuman tactile sensing

14:40-15:05 (20 min + 5 min Q/A)

**Robert Howe**

**Title:** Using Tactile Signals and Grasp Analysis for Real-time Stability Prediction

15:05-15:30 (20 min + 5 min Q/A)

**Peter Allen**

**Title:** MAT: Multi-Fingered Adaptive Tactile Grasping via Deep Reinforcement Learning

## 15:30-16:00

### Paper presentation

15:30-15:40

*Active Tapping via Gaussian Process for Efficient Unknown Object Surface Reconstruction*

Su Sun and Byung-Cheol Min.

15:40-15:50

*TIAGo RL: Simulated Reinforcement Learning Environments with Tactile Data for Mobile Robots*

Luca Lach, Robert Haschke, Francesco Ferro, Helge Ritter

15:50-16:00

*Towards a soft robotic, haptic feedback seat for autonomy level transitions in highly-automated vehicles*

Jan Peters, Bani Anvari, Annika Raatz and Helge A. Wurdemann.

16:00 -16:25 (20 min + 5 min Q/A)

**Lynette Jones**

**Title:** Thermal and Tactile Sensing and the Development of Multi-sensory Cutaneous Displays

16:25-16:50 (20 min + 5 min Q/A)

**Allison Okamura**

**Title:** Towards Proprioception and Exteroception for Soft Growing Robots

16:50-17:15 (20 min + 5 min Q/A)

**Kevin Lynch**

**Title:** The Visiflex tactile and wrench-sensing fingertip

17:15-17:40 (20 min + 5 min Q/A)

**Yon Visell**

**Title:** Haptic Sensing, Perception and Soft Mechanics

**17:40-18:10**

### **Paper presentation**

17:40-17:50

*An Active Extrinsic Contact Sensing for Generalizable Insertion Strategy*

Sangwoon Kim and Alberto Rodriguez

17:50-18:00

*Active Visuo-Tactile Object Pose Estimation*

Prajval Kumar Murali and Mohsen Kaboli

18:00-18:10

*Under Pressure: Learning to Detect Slip with Barometric Tactile Sensors*

Abhinav Grover, Christopher Grebe, Philippe Nadeau and Jonathan Kelly.

**18:20 -19:20**

### **Panel Discussion**

### **Best Paper and Presentation Award**