



Tactile feedback enriched interaction through virtual reality and beyond

WP8 – Dissemination, exploitation & communication

D8.4 Reports on stakeholder workshops and demonstrator presentations 1

Dissemination level: Public

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REVISION HISTORY

Modification Description	Author	Date
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ACRONYMS

IMM: IMMERSION

MR: Mixed Reality

TEC: FUNDACION TECNALIA RESEARCH & INNOVATION

TECSR: TECNALIA SERBIA DOO BEOGRAD

VR: Virtual Reality

XR: Extended Reality

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EXECUTIVE SUMMARY

<p>Background</p> <p>The Alpha demonstrator prototype has been reported previously in D7.1. One of the integrated prototypes was intended to be used for demonstrations to stakeholders.</p> <p>The goal is to obtain feedback and perception of such a system in the industrial community.</p>	<p>Aim</p> <p>This document describes the first workshop with stakeholders that was organized by Immersion (IMM) in order to discuss, meet and set up a strong network of industrials around the topic of TACTILITY.</p>
<p>Approach</p> <p>A one-day workshop has been organized in Paris with pre-inscription. An XR experiment has been implemented in order to demonstrate the technologies in low fidelity (TRL 4). The experiment has been designed as a pedagogic experiment to introduce electrostimulation. Such workshop aimed to feed specification deliverables such as D4.2 with needs from the stakeholders: feelings, technical, usage.</p> <p>Before the workshop, the integration of the XR experiment was also a practical exercise allowing to underline the capabilities and limitations of the current state of the technology.</p> <p>In parallel due to the limitations to organize presential events caused by the COVID-19 outbreak, a webinar to introduce the use of electrotactile feedback for extended reality solutions.</p>	
<p>Findings and results</p> <p>This workshop highlighted three important elements.</p> <p>Firstly, the sensation produced by electrostimulation is not generally accepted and many users fear that they will not be able to withstand such stimulation in their professional activity.</p> <p>This point immediately refers to the second element emerging from this workshop: the calibration. Electrostimulation is extremely variable between users, but also over time for one user. Dynamic self-calibration seems essential at this stage.</p> <p>Finally, the third element concerns the use of such a system in a Mixed Reality experiment. The multimodality of these experiences will require a perfect synchronization between the modalities. Authors will need a technical means to ensure simultaneous stimuli.</p>	
<p>Impact</p> <p>This document contains feedback that will feed all the deliverables involved in the specification of the final product.</p>	<p>Planned dissemination and/or exploitation</p> <p>Dissemination level of this deliverable 8.4 is public.</p>

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1 INTRODUCTION

TACTILITY is a multidisciplinary innovation and research action with the overall aim of including rich and meaningful tactile information into the novel interaction systems through technology for closed-loop tactile interaction with virtual environments. By mimicking the characteristics of the natural tactile feedback, it will substantially increase the quality of immersive VR experience used locally or remotely (tele-manipulation). This is achieved using transcutaneous electro-tactile stimulation delivered through electrical pulses with high resolution spatio-temporal distribution synchronized with the VR environment.

Designed as an iterative project, this workshop is organized in order to recover initial feedback from stakeholders and end users. This very early survey should provide first impressions on the feeling of such feedbacks and on their usefulness and contribute to the refinement of the specifications defined for the TACTILITY system. It was also an opportunity to inform the XR community about TACTILITY project and our progress.

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2 FIRST WORKSHOP WITH END USERS

2.1 The Alpha Demonstrator

As reported in D7.1 “Report on Alpha stage demonstrators” a specific Alpha demonstrator was developed for demonstrations of the system to stakeholders, this demonstrator was developed having in mind specifically this workshop.

This demonstrator set-up included the TACTILITY stimulator (see D2.8) and the first version of the TACTILITY electrodes (see D2.2) that provide a basic electro-tactile feedback, and this system was linked with an Mixed Reality headset as the Hololens2, that was in charge of the control of the stimulation.



Figure 1 - Physical set-up of the demonstrator

The MR application was divided into two different steps, first, with a pedagogical approach, a tutorial on the usage of the system was provided where the placement of the hand and the electro-tactile stimulation was explained. Then, two different stimuli were provided to the user: rectilinear motion over the fingers and weight simulation.

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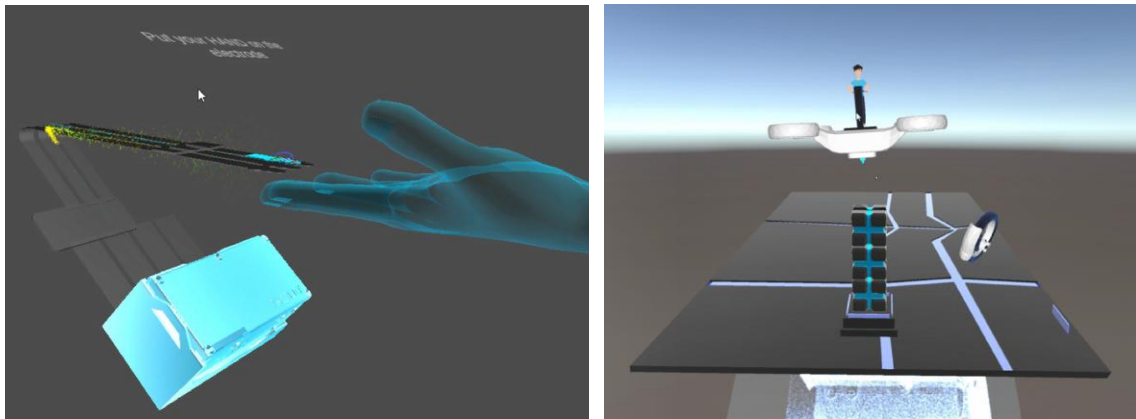


Figure 2 - The two steps of the MR application

2.2 Workshop organisation

The workshop was designed to last one day with three 2-hour sessions, and it took place in the 12th of March at a coworking area: “La Galerie Café Coworking” 39 Rue Truffaut, 75017 Paris.

In order to have a maximum number of participants, IMM proposed to test for the first time the new Varjo headset product in parallel with the TACTILITY experience. The idea was to join and discover a recent state of the art product and a technology that will be the state of the art of tomorrow.

With a registration form, the traceability of people interested in this type of device was ensured. Through such a precocious meeting, the idea was to arouse the interest of the community and to mobilize the community on the TACTILITY project and its theme.

As dissemination actions, IMM distributed a newsletter to all its clients. The company also relayed the message on social networks (Twitter, LinkedIn, Facebook) and using TACTILITY’s web site. This dissemination campaign has been also supported by a large effort of phone calls.

Finally, more than 100 people and 50 companies were registered (SME and large groups). Unfortunately, due to Covid-19 outbreak, several last-minute cancellations happened. The workshop was one day just before the measure of general confinement in France. Despite this unexpected public health issue, IMM finally received more than 40 participants.

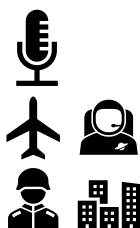
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50 companies and 10 public institutions registered
21 companies and 4 public institutions represented




106 people registered
44 participants
 Several profiles: Users, App. Developers, Tech. Providers, Researchers



4 journalists from the trade press were present.
 Different fields of application represented during the day:
 aeronautic, space, military, manufacturer.

Figure 3 - Figures of participants in the workshop

To gather feedback from participants during this event, a quick questionnaire was provided to each one in order to keep a trace of its comments.



PROJECTION

Nom, prénom : _____ Fonction : _____

Dans quel domaine travaillez-vous ? _____

Avez-vous déjà utilisé des gants haptiques ? _____

Si oui, quel était l'objet de la démonstration ? _____ Société : _____

qu'avez-vous pensé de l'expérience proposée ? _____

Selon vous, dans quel type d'activité ce type de ressentis serait-il le plus intéressant ?



<input type="checkbox"/> Achat	<input type="checkbox"/> Administratif
<input type="checkbox"/> Assistantat / Secrétariat	<input type="checkbox"/> Commercial / Vente
<input type="checkbox"/> Communication / Documentation	<input type="checkbox"/> Direction générale
<input type="checkbox"/> Entretien / Maintenance	<input type="checkbox"/> Finances / Gestion / Comptabilité
<input type="checkbox"/> Informatique / Multimédia	<input type="checkbox"/> Juridique
<input type="checkbox"/> Logistique	<input type="checkbox"/> Marketing / Design
<input type="checkbox"/> Méthodes	<input type="checkbox"/> Production
<input type="checkbox"/> Qualité / Sécurité	<input type="checkbox"/> Recherche / Etude laboratoire
<input type="checkbox"/> Relations clients / Service après vente	<input type="checkbox"/> Ressources humaines

En quoi les sensations haptiques seraient-elles utiles dans ce domaine ? _____

Est-ce que l'utilisation de gants haptiques pourrait avoir un intérêt pour vous dans l'exercice de vos fonctions ? _____

Pour l'un de vos collègues ? _____

Ensemble, imaginons demain...

PERCEPTION DU SYSTÈME

		AttrakDiff							
		1	2	3	4	5	6	7	
Humain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Technique
Miscelée	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Me sociable
Paisant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Déplaisant
Original	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Conventionnel
Simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Compliqué
Professionnel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Amateur
Agréable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Désagréable
Prévisible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Imprévisible
Bas de gamme	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Haut de gamme
Repoussant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attirant
Bon	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Mauvais
Confus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Clair
Audacieux	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Prudent
Ennuyeux	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Captivant
Motivant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Décourageant

RESSENTIS PHYSIQUES

		DEEP (Design-oriented Evaluation of Perceived Usability)				
		1	2	3	4	5
SENSATION						
L'impulsion électrique est désagréable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
L'impulsion électrique est douloureuse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
L'impulsion électrique est douce	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Le toucher est froid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
La sensation était la même sur tous les doigts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
DISCERNEMENT						
L'impulsion électrique est perceptible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
J'ai perçu le mouvement du véhicule allant de gauche à droite	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
J'ai ressenti la vitesse de déplacement du véhicule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
J'ai perçu le mouvement du véhicule allant de bas en haut	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
J'ai eu l'impression que le poids des caisses était de plus en plus lourd	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Il y avait un décalage entre ce que je voyais et ce que je ressentais	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EFFORT PERÇU						
Utiliser ce système fait sans effort visuel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Utiliser ce système m'a fatigué physiquement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pour ressentir les impulsions je devais me focaliser sur ce que je voyais	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vers la fin de l'expérience, j'ai dû me concentrer davantage pour ressentir les impulsions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

1 = Pas du tout d'accord, 5 = Tout à fait d'accord

Figure 4 - Questionnaire used to gather feedback from participants

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Finally, the workshop was held with 44 participants of 25 entities, some pictures can be found below. Also, a video of the event has been prepared and has been disseminated through IMM and TACTILITY’s websites and social networks.



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Figure 5 - Few pictures of the event

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3 WEBINAR

Given the impossibility of organizing presential events during the lock-down measures in Europe, TECNALIA organized an online webinar titled “Sensory feedback technologies for prosthetics and extended reality”. In this webinar TECNALIA introduced attendees into the world of sensory/tactile feedback by means of a multi-channel electrical stimulation technology. Also, TEC and TECSR presented some of the projects, amongst them TACTILITY, where throughout the last 8 years both have investigated the best ways to achieve selective sensory stimulation that can be used to provide user feedback. The use of this type of feedback has opened the way to investigate the use of this feedback modality in more general applications like XR.

The dissemination of this webinar was done through all TECNALIA’s channels and through TACTILITY’s website and Twitter account. After this effort 67 participants of 40 different companies or institutions were registered to the webinar.

The webinar was given on the 27th of May by Dr. Thierry Keller (TEC) and Dr. Matija Strbac (TECSR) using TECNALIA’s platform running on MS Teams, where 59 of the registered participants attended the event.

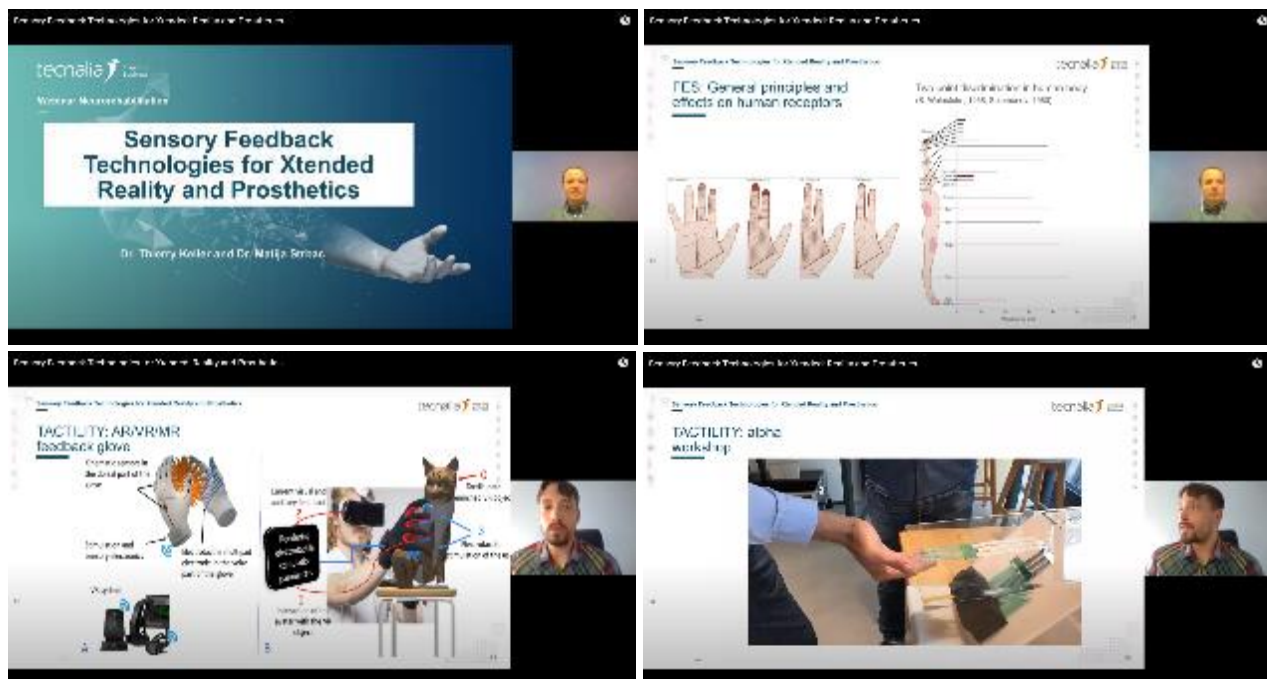


Figure 6 - Few screen captures of the webinar

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4 CONCLUSIONS

As mentioned before, two events have been organized to show and disseminate to stakeholders the TACTILITY system and system's capabilities to provide electro-tactile feedback. Both events have been impacted by the COVID-19 outbreak, with several last-minute cancellations on the presential workshop organized in Paris and with the impossibility of making real demonstrations of TACTILITY on the webinar given by TEC.

Anyway, the main objectives of starting to show and spreading TACTILITY system and goals amongst stakeholders have been met, and at the same time feedback information from participants that will be used to review or reformulate the specifications for the system has also been gathered. For example, there are some challenges that have been already identified that could be addressed:

- Having tools for the synchronization of tactile feedback with other modality of the application.
- Replace current Bluetooth connection in order to decrease latency.
- Develop an autocalibration system for the electro-tactile feedback.
- Further than reproducing real properties of the objects, it would be more interesting and useful to build a vocabulary of artificial stimuli. In addition, these artificial feedbacks could be pleasant and identifiable in order to create a strong link with customers.