



SHARESPACE Newsletter #2

SHARESPACE in short

SHARESPACE is a research project funded under Horizon Europe in the field of XR/VR. The next two years, 14 partners all over Europe are aiming to realize the goals and visions of the project. The vision of SHARESPACE is the creation of future Social Hybrid Spaces (SHS) shared by humans and avatars engaged in embodied collaborative tasks, where social sensorimotor primitives are transparently captured through mobile connected innovative sensors, and then reconstructed using novel extended reality (XR) technology. Applied in three different real-world scenarios (health, sport, and art) and two proof-of-principles (social connectedness & amplification), SHARESPACE tests the hypothesis if levels of collaboration and synchronization in virtual spaces will improve through AI amplification of sensorimotor data.

In the following newsletter, the SHARESPACE team wishes to update everyone with an interest in the project on the overall progress and the more specific progress made in the different work packages. We want to end this newsletter with a short glance into the near future.



I: SHARESPACE Consortium in Valencia, November 2023

Work packages

WP1: Overall Framework Definition

SHARESPACE is a highly interdisciplinary project aiming to push the boundaries on multiple scientific fields and disciplines. To create a common understanding amongst the partners on the different terms that exist within the research field we wish to address, we are constantly updating our living glossary. It is our goal to transform our glossary into a publication soon.

WP2: Sensorimotor primitives

This work package concerns itself with the scientific research surrounding the two proof-of-principles in the project.

Amplification

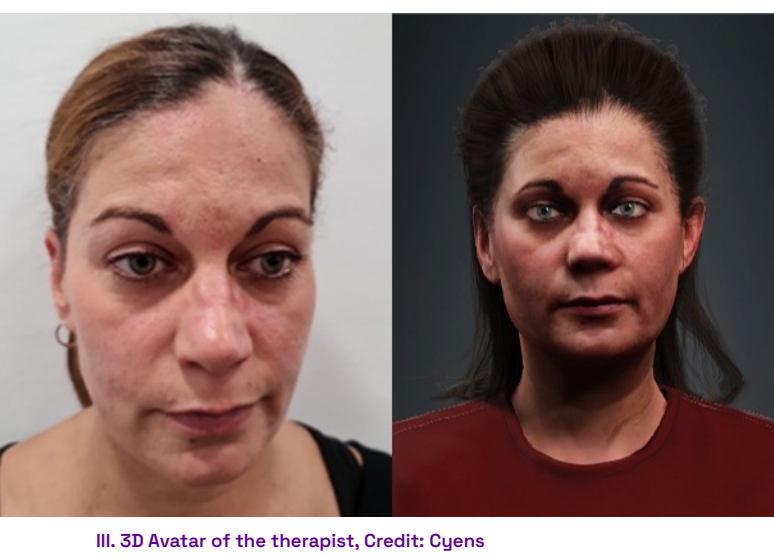
This proof-of-principle focuses on the identification of social sensorimotor primitives, which is social information encoded in our movements. Through an experimental set up where participants have to pass along a cube that sometimes provides an unpleasant stimulus, the research aims to recognize the 'hesitation to move' in the participants' data. The UKE team is currently working on demonstrations of encoding, readout and transmission of information through movement kinematics. Also, the team managed to create a new publication on 'New validation of kinematic encoding and readout in patients with psychosis'.

Synchronization

The UM-EuroMov scientists are currently conducting baseline experiments to test the core idea that sensorimotor synchronization between humans engaged in a collaborative task can increase pain thresholds, alleviate discomfort, and strengthen social connectedness. Figure III below reveals, for one of the tested quintets (Figure II), the arm oscillations of the participants when instructed to move in sync. It shows the perturbation in group synchronization when one participant (P1) is receiving occasional uncomfortable electro-dermal stimulations. The full results will allow refinement of these studies to be replicated in VR — virtual agents will exhibit various forms of autonomy — to minimize the effect of the perturbation on group synchrony.

WP3: Ego-centric Visual-Inertial body tracking, Scene Capturing, and XR Display

The work in this work package focuses on three main areas: 1) Capturing the human body. This involves research surrounding how to capture human movement as accurately as possible, in a user-friendly way. Current research focuses on minimizing the amount of sensors needed on a motion capture suit. 2) Capturing the scene. This area aims to swiftly capture 3D scenes using 360-degree cameras, which is currently executed by DFKI in collaboration with Ricoh. 3) Display via XR glasses. At the moment, most of the SHARESPACE research is in Phase I, which focuses on VR research. Therefore, the XR research is still in its preparatory phase. However, the first attempts at the integration of eye tracking in the HMD are currently made.



III. 3D Avatar of the therapist, Credit: Cygus

Goalem and CYENS are currently working on avatar representation and animation as well as manipulation within eXtended Reality (XR) environments. Currently the team is focusing on the health scenario; the team is exploring the creation of avatars representing therapists, patients, and the hospital environment itself. In this scenario, special focus is given to the representation of the therapist since this should be as close as possible to the actual person. To do this, the team scanned the head of the therapist using photogrammetry, converted it to an animatable head which was then attached to a virtual body; this avatar can now be animated using motion capture technologies developed in WP3. Additionally, the team experimented with different avatar representations, utilizing single photos of a face; some of the faces were de-anonymized using AI models. The team then uses measurements of patients to adjust the body proportions of the avatars. The process is currently a bit manual, so the team is exploring on how to make this more fluid. Moreover, the team is exploring on how to visualize L1 and L3 avatars in the XR setting to the different users; the therapist should know who the L1 avatars are whereas the patients should not know who the L3 avatar are.

In addition to the above, the CYENS team is exploring style motion transfer using state-of-the-art methods. This research aims to utilize advanced techniques to transfer motion styles across different scenarios while preserving the content of the input animation. Specifically, currently the team is focusing on generating diverse styles with a keen emphasis on gender and age.

Finally, the team from CYENS is creating a 3D model of the hospital room where the experiments are taking place. First, the team scanned with room using a laser scanner and then recreated the space using 3D editing software (Blender). This was done to optimize the rendering quality for VR and remove any artifacts.



IV: Screenshots of the work-in-progress 3D model of the hospital room, Credit: Cygus

WP5: Cognitive Architectures

The researchers at CRdC are working to refine the cognitive architectures already developed for the proof of principles (L2 for the PoP of amplification and L3 for the PoP on synchronization) and on developing the remaining implementations (L3 for PoP of amplification and L2 for the PoP on synchronization). These architectures will then be instrumental to addressing the scenarios conceptualized within the project. Current challenges include a thorough characterization of how exactly the behavior learned by L3 is able to improve synchronization in a network of virtual humans, a mathematical characterization of the effect of perturbations on the motion of people performing a coordination task, and a more thorough validation of L2, when used to display or hide specific emotions, on larger datasets.

WP6: Scenarios

Art
The Ars Electronica Futurelab has finalized the SHARESPACE Open Call 2023. We were ecstatic to receive over 60 promising applications for the collaboration. With the help of the 'Artistic User Advisory Board, one project has been chosen. 'State of Play' (working title) is a project suggested by a group of young artists based in Berlin & London. The team includes 3D artists, art directors, digital artists, and game developers. The project's goal is to bring adults in touch with their inner child through the act of 'play'. Highly influenced and inspired by videogame 'boss encounters', State of Play creates an expansive and interactive performance involving a central figure (offsite performer) and the onsite participants. In the immersive environment of Deep Space 8K, the floor projection functions as a game controller for the onsite participants, while the wall screen showcases gameplay. Both screens are utilized for cutscenes, enhancing the overall cinematic and immersive experience.

Furthermore, the Futurelab is exploring with the technical production of their future artistic exploration and hope to make good progress in the coming time to simultaneously be able to support the external artist in their realization.

Health

The work performed regarding the health scenario has been a joined effort to define the technical and psychosocial specifications for the validation of phase one of the scenario. The most important achievement, if the SHARESPACE health scenario is feasible, acceptable and effective, is that this could make a significant contribution to improving access to rehabilitation intervention for chronic pain patients, reducing waiting lists and reducing time and cost of the intervention (being able to conduct rehabilitation sessions at home, reducing financial costs of trips, reducing travel time to the hospital, and reducing time of therapist). Another important achievement will be to be able to personalize the intervention based on a more accurate capturing of the movements data and more accurate feedback. And all this in a social virtual environment, that is, gaining in personalization without losing the group effect.

One important contribution of SHARESPACE compared to the use of other technologies (for example, online video rehabilitation) is that the technology (remote VR and AR) will simulate group sessions. The participants will perform the rehabilitation exercises with other participants (also avatars) in a shared space, promoting social presence and social connectedness. In addition to the social presence effect, the VR scenarios will provide feedback to both patients and the therapist about the performance of the rehabilitation exercises, contributing to a more accurate monitoring of the patients' progress.

In Phase 1 of the SHARESPACE project a usability study will be conducted. A meeting devoted entirely to the health scenario will be held in Vall d'Hebron hospital in Barcelona February 22nd and 23rd. The main goal of the meeting is the integration of the work done for the different partners with the aim to conduct the usability in this second year of the project.

Sport

The MimeTIC team at Rennes University's Inria Centre aims to revolutionize training for racing cyclists by enhancing their social interaction skills and perceptual abilities within Extended Reality (XR) environments. Specifically, the sport scenario focuses on optimizing breakaway maneuvers, crucial in competitive cycling, by leveraging AI-driven cognitive architecture and sensorimotor communication. Through a meticulous research process, the team is developing immersive training devices that amplify subtle signals of impending attacks, enabling racers to detect and respond effectively to strategic moves within the pack. By integrating advanced motion analysis technology and AI algorithms, the project creates realistic scenarios that bridge virtual and real-world cycling experiences. The next major showcase for the sport scenario will be at this year's Olympic Games in Paris. Read more specific information about the Sport Scenario in Inria's latest newsletter [here](#).



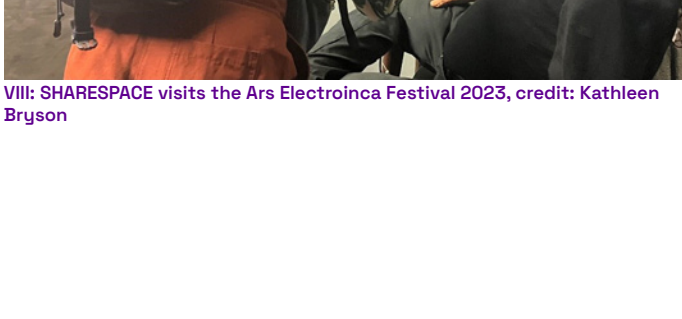
VII: Research on the Sport Scenario, Credit: Inria

Even though the first year of SHARESPACE was all about the planning and preparation of the scientific trials and the real-world scenarios, the SHARESPACE team did not miss opportunities to show the work that they have done. We are very proud of the six scientific publications we have been able to bring out this year. Because SHARESPACE follows the Open Science policy of Horizon Europe, you can find all of them on our website here. Furthermore, we were able to participate in a variety of events such as the Ars Electronica Festival, Stereopsia Europe, the ACM Conference, and the 'Research to Reality' event in Brussels. The coming year you can find us at the Ars Electronica Festival 2024, the Olympic Games in Paris, and the World Congress of Pain in Amsterdam.

Ethics by Design (EbD) is an emerging approach to the design of new technologies that embeds ethical considerations into all stages of development, including from the very beginning. SHARESPACE provides an exciting opportunity to advance the state of the art for ethical technological design. The ethics team at DMU are currently developing an ethical framework and roadmap to explain the issues that arise in the development of AR/VR/XR technologies, provide new approaches, adjust methods within the design process and mitigate undesirable effects.

The coming time

The coming half a year is going to be crucial for the SHARESPACE project. We are preparing and working hard on the completion of Phase I as we are working towards our midterm review. We need to deliver a successful first round of the real-world scenarios, further develop our research on the proof-of-principles and cognitive architecture and present our work at a multitude of events. Never a dull moment! The next SHARESPACE meeting will take place in April in Hamburg. If you are interested in our project, or have any questions, please make sure to follow us through the corresponding channels, and don't hesitate to reach out.



VIII: SHARESPACE visits the Ars Electronica Festival 2023, credit: Kathleen Bryson

www.sharespace.eu

<https://www.linkedin.com/company/sharespace-eu/>

https://twitter.com/Sharespace_EU

<https://www.youtube.com/@SharespaceEU>

contact@sharespace.eu



II: Experimental setup at EuroMov

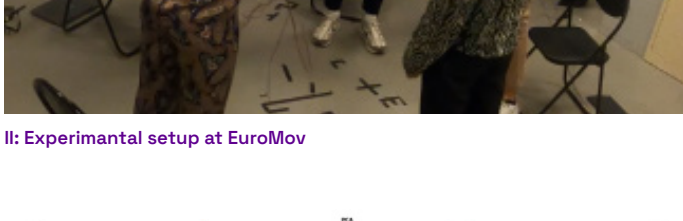


Figure III: Ongoing synchronisation experiment at UM-EuroMov. Arm oscillations of the participants when instructed to move in sync, over time (left) and in the phase space (right). Perturbation in group synchronization is shown when one participant (P1) receives occasional uncomfortable electro-dermal stimulations (small black triangles)

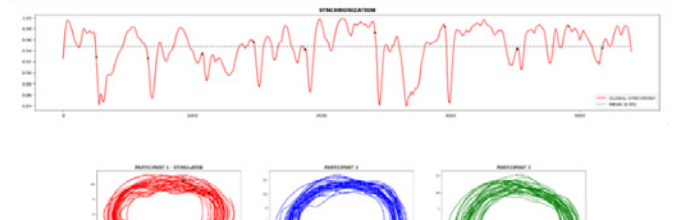


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