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SHARESPACE

Embodied Social Experiences in Hybrid Shared Spaces

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Involved Institutions	**UM (lead)** + All
Document Description	This deliverable presents the first step (M4) of the unified SHARESPACE vision, in form the first version of the Glossary.

CONTENTS

INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This deliverable presents the first step toward a unified, operational SHARESPACE vision. It reports the activity of the consortium since the beginning of the project in January 2023 toward building this common vision at the crossover of several disciplines (e.g., Neurosciences, Cognitive Sciences, Movement Sciences, Clinical Sciences, Mathematics, Computer Sciences, Engineering Sciences, Computer Vision and Animation) and non-academic partners (cutting-edge technological companies, healthcare centre, art and research institution).

1.2 STRUCTURE OF THE DOCUMENT

This document is structured as follows:

- The first part of this document includes a description of the project's inter-disciplinarity and the necessity to build a common SHARESPACE framework.
- Next, we describe the process we have adopted to start building this framework, with one of the first achievements encapsulated in the first version of **SHARESPACE's Living Glossary**.
- The results section includes (i) the five structures, or backbones, we have produced, which witness the boiling interactions between partners during the first 4 months of the project, (ii) the 135 terms we think constitute together the necessary starting point to build a common SHARESPACE Living Glossary, and (iv) one definition for each of these terms.
- Finally, we list the envisaged follow-up activities related to the Glossary, which is bound to evolve in the next months.

2 WHY A COMMON VISION

Sharing a common vision among scientific disciplines and partners from various backgrounds is essential for tackling the complex scientific challenges set out in the SHARESPACE project. In general, collaborating with diverse groups can bring unique perspectives, skillsets, and resources to a project, leading at the end to more innovative and comprehensive solutions, and SHARESPACE is no exception.

Furthermore, interdisciplinary collaboration encourages scientists to approach problems from different angles, sparking creativity and critical thinking. Sharing a common vision is key in SHARESPACE to ensure that all partners have a clear understanding of the project's main concepts, goals, and objectives, which helps to streamline communication and avoid misunderstandings. This shared vision is essential at three levels. First and foremost, **it is essential at the conceptual level, as Extended Reality and metaverse-worlds (XR spaces, or shared hybrid spaces) require us to revisit some of the basic concepts from various academic disciplines**. For instance, Motivation, Motor Control, or Synchronization, to take just a few notions, cover fundamental biological and psychological mechanisms that are both similar and different between real and hybrid environments, and highlighting those similarities and differences is crucial **at this burgeoning phase of the European Metaverse**. Second, a shared vision is essential at the more pragmatic level of communication, to name an apple an apple and a tree a tree. Words have different meanings in different disciplines, they even have different meaning across various schools of thought in the same discipline, as we will see below, and **it is necessary in our large multidisciplinary consortium that we use a unique concept to characterize a particular reality, being natural, virtual, augmented, or mixed**. Third and this is not a minor issue, sharing a common vocabulary can foster mutual respect and trust among collaborators, which is **critical for achieving a solid project's impact and for building successful long-term partnerships**. Finally, when different stakeholders from academia and industry collaborate on solid and common ground, the results can lead to **practical applications and technology transfer**, driving innovation and economic growth.

2.1 OUR DISCIPLINES

The SHARESPACE consortium covers more than twenty scientific and technological fields of expertise in which basic concepts, for instance, *human and computer perception, ethics in design, motor cognition, motion capturing and real-time tracking, motor synchronization, cognitive architecture, animation, Virtual Reality, video data processing, psychology of health and pain, psychology of motivation, sonification, sport performance science* etc – are not inherently overlapping or connected. Moreover, as the project targets still uncharted XR spaces territories, even those basic concepts have to be revised to account for these new hybrid realities. The expertise present in SHARESPACE is listed in Table 1 below (revised from the Table 3.2.1 presented in the SHARESPACE proposal).

TABLE 1: **OVERVIEW OF EXPERTISE CONSTITUTING THE SHARESPACE CONSORTIUM**

EXPERTISE	PARTNER														
	DFKI	UM	CRdC	UKE	ALE	UJI	Golaem	LST	CYENS	Ricoh	DMU	INRIA/ Rennes-2	AE	VHIR	IMT
VISION/REQUIREMENTS/DESIGN	XX	XX	X	X	X	X	X	X	X		XX	X	X		X
SOCIAL INFORMATION	X	XX	X	**XXX**		X			X		X	X			X
SOCIAL INFORMATION EN-/DECODING	**XXX**		XX	X			X	X	X	X					
BODY MOTION SENSING	XX							X	X	**XXX**					
XR GLASSES + PERCEPTION	X	X	X	X			X	**XXX**	X						
HUMAN JOINT ACTION		**XXX**	X	XX											
AVATAR RENDERING	X		X				**XXX**		XX						
XR ENVIRONMENT, SONIFICATION & MAPPING		X					XX		**XXX**						**XX**
COGNITIVE ARCHITECTURE	XX	X	**XXX**	X		X			X		X				
COMMUNICATION PLATFORM	X		X		**XXX**			X	X	X					
INCLUSION, DIVERSITY AND DEMOGRAPHICS						**XXX**					XX	X	X	X	
ETHICS		X	X	X		XX					**XXX**				
Scenario I: HEALTH - Social Low Back Pain		X		X		XX			X					**XXX**	X
Scenario II: SPORT - Family Peloton Cycling		X		X								**XXX**			X
Scenario III: ART - Shared Creativity		X		X		X							**XXX**		X
Contribution to WPs	WP3;1	WP6; 2	WP5; 1	WP2; 6	WP4	WP1; 6	WP4	WP3; 1	WP4	WP3	WP1; 6	WP6; 4	WP6; 7	WP6	WP4; WP5

Note. XXX – denotes worldwide expertise level; XX – substantial expertise, X – complementary expertise.

2.2 OUR ORIGINS

SHARESPACE is composed of 16 partner institutions (14 partners + 2 affiliated entities): 12 involved in basic research, 2 from Industry, and 2 SMEs. This conventional separation hides a more complex reality that is we believe a strong starting point for building a successful common vision. Several academic partners, for instance DFKI, UM, IMT, CRdC, CYENS, INRIA, AE, have ties with the industrial world and are used to mixed public-private R&D collaborations. Reciprocally, industrial and SME partners, either originate from academic research (GOLAEM), or have ties with it (e.g., RICOH, ALE, LST) and easily bridge the gap between both worlds. More, several research institutions, although doing fundamental research (e.g., UM, UKE, UJI, DMU), are also conducting clinical and applied research and work hand in hand with our clinical partner VHIR, our Sport-related partner INRIA/RENNES2, and our Art partner AE. This intertwined set of complementary expertise provides a solid ground on which the SHARESPACE common vision will be built over the 36 months of the project.

3 THE PROCESS

As anticipated in the original SHARESPACE proposal (p. 3), we decided to move forward on the path of the SHARESPACE common vision through the elaboration of the **SHARESPACE Glossary**. A glossary of terms is an excellent way to build a common vision between scientific disciplines and partners coming from different backgrounds on a scientific subject. It provides a standardized vocabulary and definition of key terms that are commonly used across different fields, ensuring that everyone involved in the project understands the terminology being used. This helps to avoid misunderstandings and communication breakdowns that can occur when using technical jargon that is unfamiliar to some members of the team. A glossary of terms can also serve as a reference guide for anyone who is new to the project or needs a refresher on specific concepts. It helps to streamline communication, reducing the time and effort required to explain complex concepts repeatedly. Furthermore, a glossary of terms can help to align the expectations and goals of everyone involved in the project, ensuring that everyone is working towards a common vision. By using a glossary of terms, scientific disciplines and partners from different backgrounds can develop a shared understanding of the project's objectives and the language required to communicate effectively.

3.1.1 Methodology

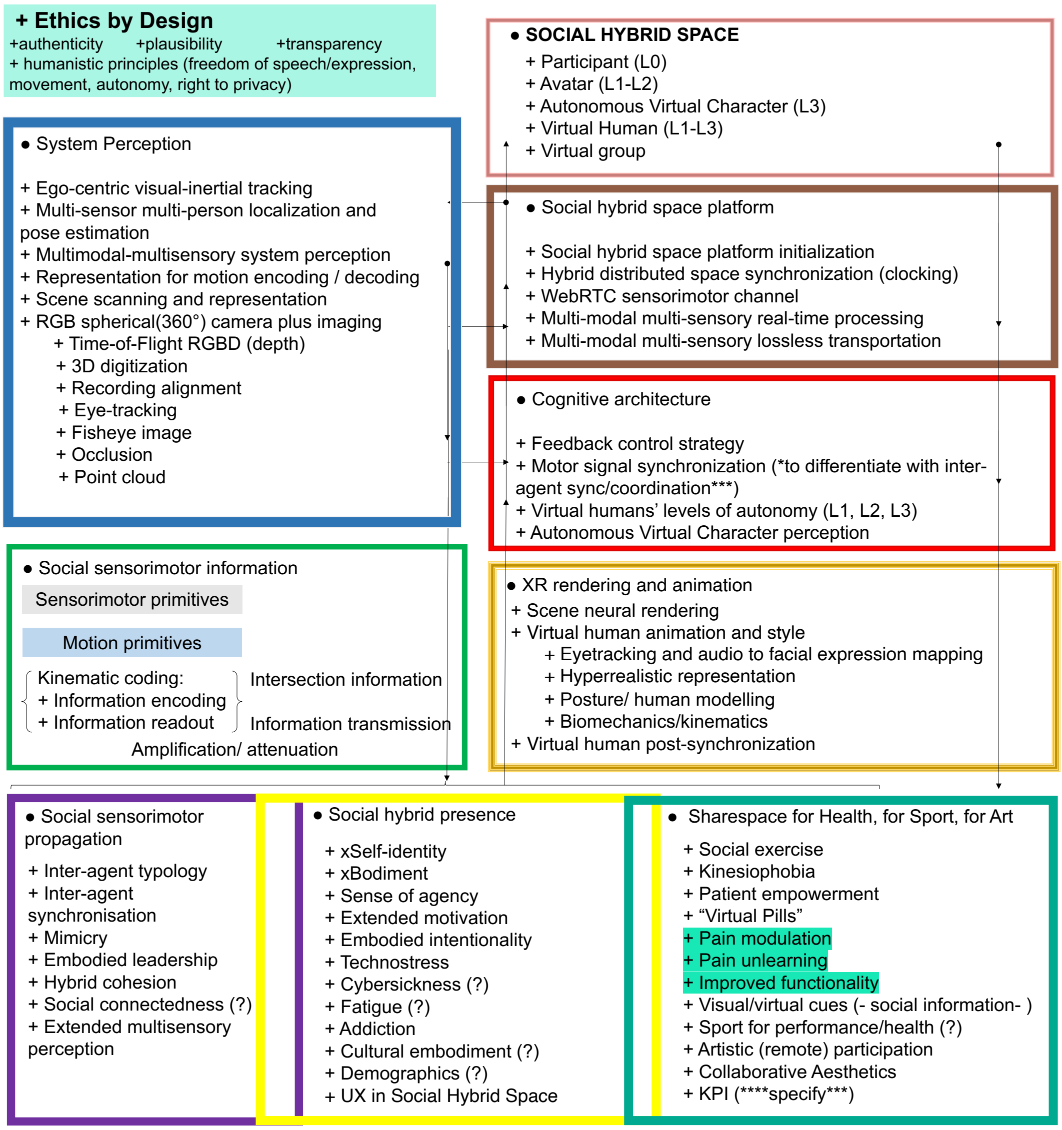
To start the activity on the SHARESPACE glossary, we adopted the following methodology. First, we agreed to adopt a **bottom-up and iterative approach** (M1), consisting in collecting all terms seen by partners as an essential starting point for the future SHARESPACE glossary, and revising terms and definitions regularly throughout the duration of the project. 135 terms have been proposed. Second, we established the starting categories in which those terms would better fit (M2-M3), **to create a unified backbone for the glossary**. At M4 and thanks to the creativity of most partners, 5 potential backbones are contrasted and are reported below. The blueprint that best depicts SHARESPACE is still in development, waiting for final specifications from the proof-of-principle and scenario definitions which will be released at M6. Third, we **collected the definition for each of the 135 terms** selected (M3) and revised them collaboratively (M4). All partners were active agents in this epistemic process, providing key terms and corresponding definitions, as well as contributing with feedbacks on subsequent iterations of this deliverable.

4 DATA COLLECTION

This section presents and analyzes the first five structures produced for Glossary, the encompassing terms and their definition.

4.1 FIVE IDENTIFIED STRUCTURES FOR THE GLOSSARY

4.1.1 Structure 1



This structure is organized by components of the SHARESPACE system. It is organized in a 'mindmap' style representation and interconnected functionally with the arrow pointers. Partners exchanged on this Structure to agree on the precise terms used. This was the initial proposal followed up with Structure 2 below.

4.1.2 Structure 2

The ETHICAL

Ethics in XR
- Authenticity
- Plausibility
- Transparency
- Humanistic principles (freedom of speech/expression, movement, autonomy, right to privacy)

The SOCIAL

Social Shared Space in XR
- VR-AR-XR
- L0-L1-L2-L3
- Virtual group
- Hybrid group

Embodied Social Information in XR
- Motion primitives / Sensorimotor primitives
- Kinematic coding: Information encoding/Specification
- Kinematic coding: Information readout/detection
- Intersection information
- Amplification/Attenuation
- Multisensory perception
- Synchronization
- ~~Inter-agent topology~~

Embodied Social Propagation in XR
- Information transmission
- Empathy
- Mimicry
- Affiliation
- Connectedness
- Bounding
- Cohesion
- Contagion
- Leadership

Social and Biological Presence in XR
- Self-identity
- xBodiment
- Sense of agency
- Embodied intentionality
- Extended motivation
- Technostress
- Cybersickness
- Fatigue
- Addiction
- Demographics
- UX in Social Hybrid Space ?

The PHYSICAL

Capturing & Processing in XR
- Ego-centric visual-inertial tracking
- Multi-sensor multi-person localization and pose estimation
- Multimodal-multisensory system perception
- Representation for motion encoding / decoding
- Scene scanning and representation
- RGB spherical(360°) camera plus imaging
- Time-of-Flight RGBD (depth)
- 3D digitization
- Recording alignment
- Eye-tracking
- Fisheye image
- Occlusion
- Point cloud

XR System Architecture
- Platform initialization
- Distributed space synchronization (clocking)
- WebRTC sensorimotor channel
- Multi-modal multi-sensory real-time processing
- Multi-modal multi-sensory lossless transportation

Cognitive Architecture in XR
- Feedback control strategy
- Motor signal synchronization (*to differentiate with inter-agent sync/coordination***)
- ~~Virtual humans' levels of autonomy (L1, L2, L3)~~
- Autonomous Virtual Character perception

Rendering in XR
- Scene neural rendering
- Virtual human animation and style
  - Eyetracking and audio to facial expression mapping
  - Hyper-realistic representation
  - Posture/ human modelling
  - Biomechanics/kinematics
- Virtual human post-synchronization

The CULTURAL

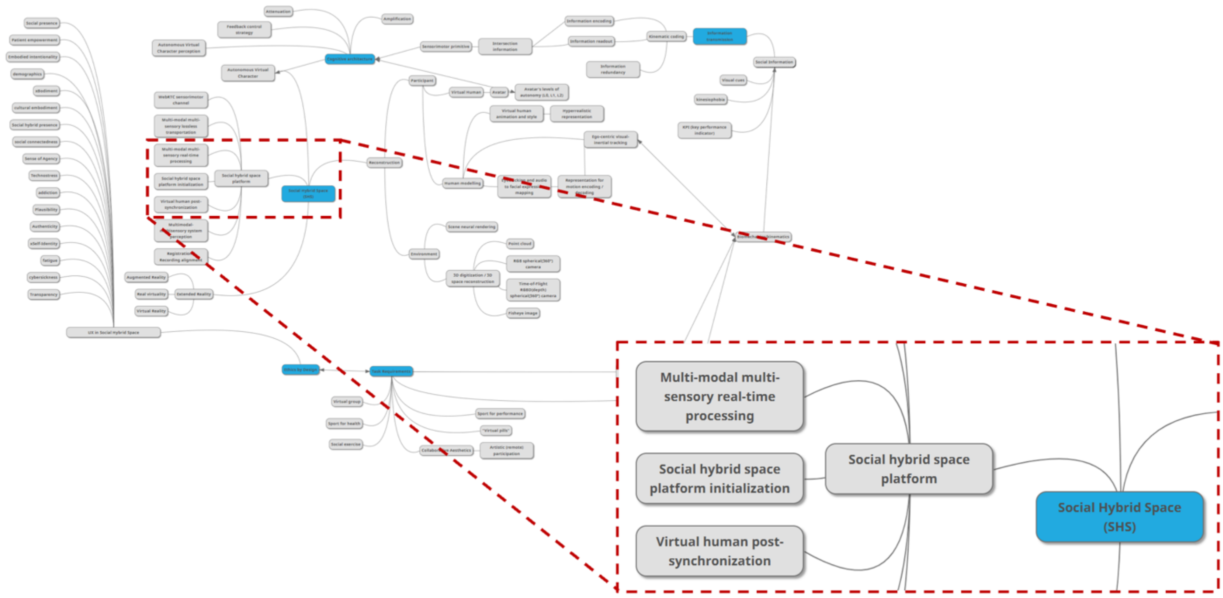
Health in XR
- Social exercises
- Kinesiophobia
- Pain modulation
- Patient empowerment
- Virtual Pills

Sport in XR
- Performance
- Wellbeing
- Retention
- Transfer
- xx

Art in XR
- Cultural embodiment
- Artistic expression
- Artistic remote participation
- Collaborative aesthetics
- xx

Note: Similarly to Structure 1, this structure is organized by components of the SHARESPACE system, but re-organised in overarching themes constituting fundamental pillars of the project: The Social, The Physical and The Cultural.

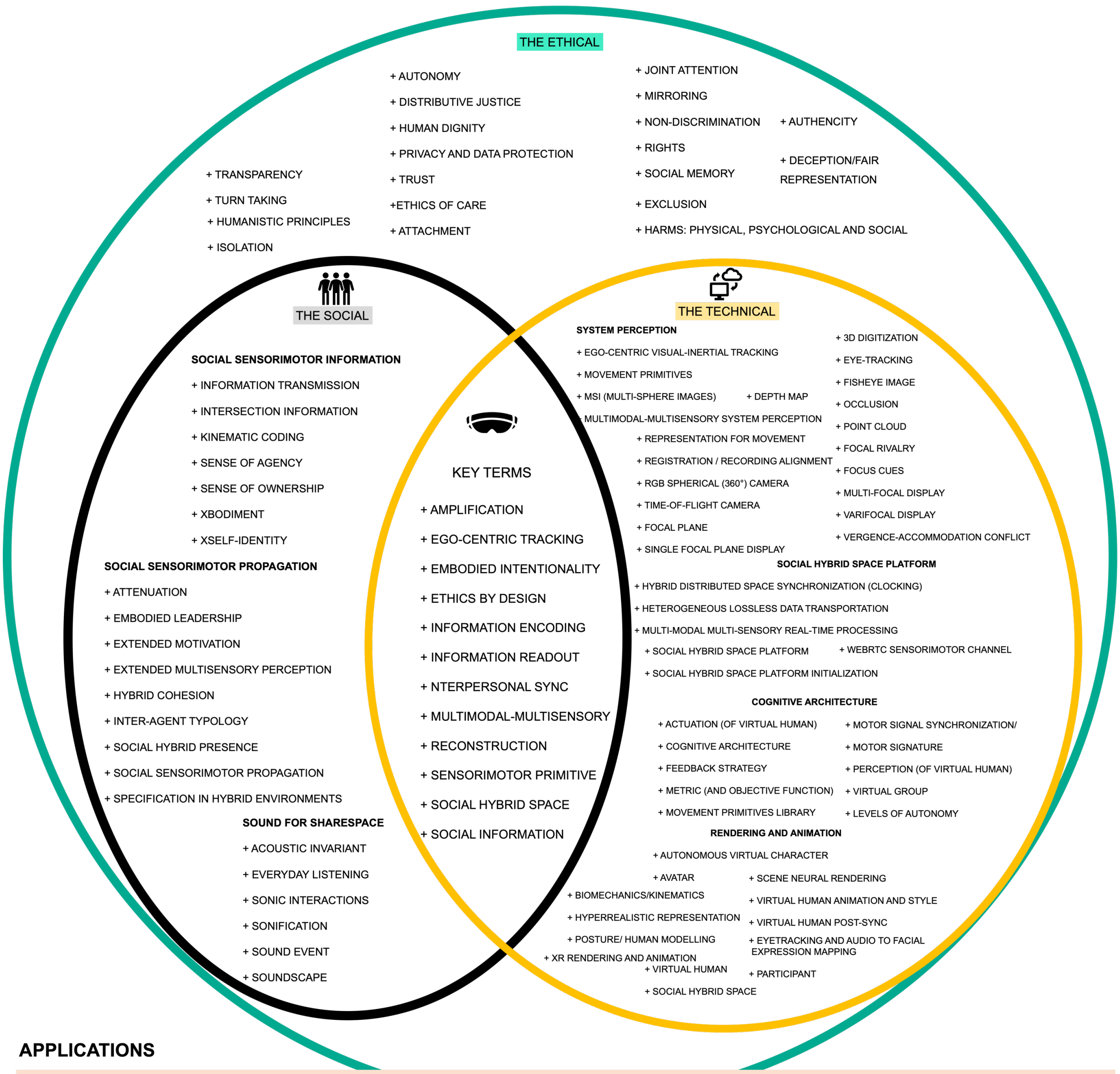
4.1.3 Structure 3



Note: This third structure adopts a 'mindmap' style, emphasizing the functional connections between the subcomponents of the SHARESPACE system. Given the number of terms used, this type of representation proves tricky to depict interaction between terms in a readable style. The figure includes a zoom in example region.

4.1.4 Structure 4

LIVING GLOSSARY



APPLICATIONS

SHARESPACE FOR HEALTH

+ ECOLOGICAL VALIDITY OF A TECHNOLOGY (PERCEIVED)
+ INTENTION TO USE A TECHNOLOGY
+ ACCEPTABILITY OF THE INTERVENTION
+ ADDICTION
+ APPROPRIATENESS (OF AN INTERVENTION)
+ COST OF A TECHNOLOGY (PERCEIVED)
+ CULTURAL EMBODIMENT
+ KINESIOPHOBIA
+ SOCIAL PRESENCE OF A TECHNOLOGY (PERCEIVED)
+ TECHNOSTRESS
+ USEFULNESS OF A TECHNOLOGY (PERCEIVED)
+ EFFICACY (OF AN INTERVENTION)
+ CYBERSICKNESS
+ DEMOGRAPHICS
+ EASE OF USE OF A TECHNOLOGY (PERCEIVED)
+ MIMICRY
+ PATIENT EMPOWERMENT
+ FATIGUE
+ FEASIBILITY (OF AN INTERVENTION)
+ FIDELITY (OF AN INTERVENTION)
+ IMPLEMENTATION COST (OF AN INTERVENTION)
+ PENETRATION (OF AN INTERVENTION)
+ PRESENCE OF A TECHNOLOGY (PERCEIVED)
+ IMPROVED FUNCTIONALITY
+ PAIN MODULATION
+ SOCIAL EXERCISE
+ VIRTUAL PILLS
+ PAIN UNLEARNING
+ PAIN
+ REACH (OF AN INTERVENTION)
+ SELF-EFFICACY (TOWARD PAIN MANAGEMENT)
+ SELF-EFFICACY TO USE A TECHNOLOGY (PERCEIVED)
+ SOCIAL CONNECTEDNESS WITHIN A VIRTUAL WORLD

SHARESPACE FOR ART

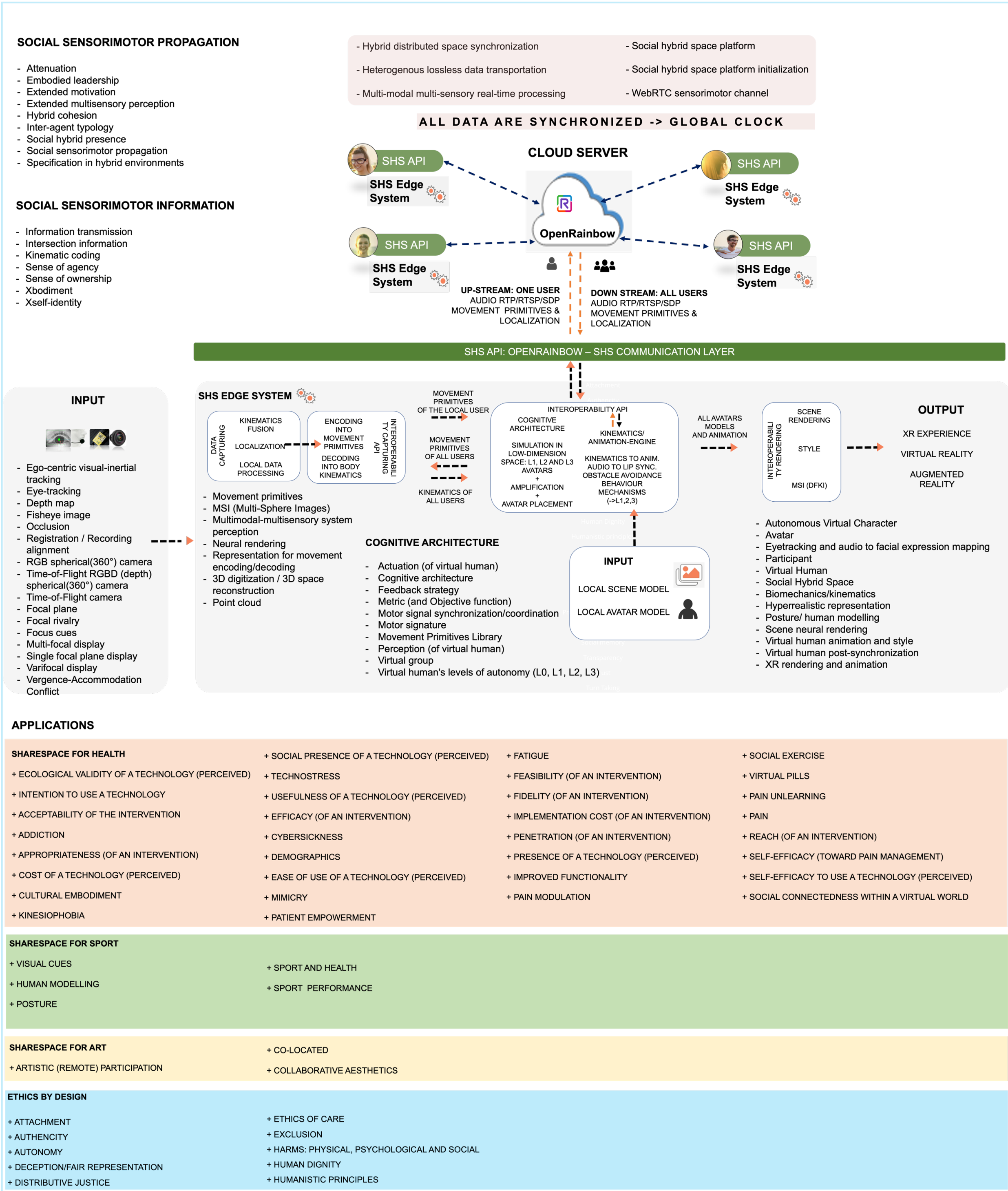
+ ARTISTIC (REMOTE) PARTICIPATION
+ CO-LOCATED
+ COLLABORATIVE AESTHETICS

SHARESPACE FOR SPORT

+ VISUAL CUES
+ HUMAN MODELLING
+ POSTURE
+ SPORT AND HEALTH
+ SPORT PERFORMANCE

Note: Inspired by Structure 2, this structure is organized by components of the SHARESPACE system, but re-organised in overarching themes such as: The Social, The Technical (sharing Key Elements – Original Terms from the original proposal), and The Ethical (encompassing all elements). The terms relevant to the real-life scenarios – SHARESPACE for Health, Sport and Art and listed below in separate boxes.

4.1.5 Structure 5



Note: This structure is organized by technical components of the overall SHARESPACE system architecture, connecting the input, the processing and the output, as defined during the plenary meeting in Barcelona (March, 2023); The Application terms in three Scenarios are listed in separate boxes along with the Ethical framework encompassing all of the themes and components of the project.

5 THE DEFINITIONS

This section presents the terms organized by themes in the current version of the Living Glossary.

5.1 SOCIAL HYBRID SPACE PLATFORM

5.1.1 Hybrid distributed space synchronization (ALE)

A technical solution that ensures time and space synchronization of virtual and real artifacts across multiple distributed rendered scenes.

5.1.2 Heterogeneous lossless data transportation (ALE)

A communication technology that supports the transportation over networks of heterogeneous data representing human communication. This technology ensures data synchronization and delivery without loss.

5.1.3 Real-time processing of distributed heterogenous data streams for XR-based communication (ALE)

A communication technology that supports real-time and synchronized encoding, decoding, and rendering of heterogeneous data representing human communication. This technology ensures synchronization between the media streams and the lowest delay between capturing and rendering.

5.1.4 Social hybrid space platform (ALE)

A collaboration platform that connects remote locations for real-time interactions and involves Participants, Avatars, and Autonomous virtual characters.

5.1.5 Social hybrid space platform initialization (ALE)

A process that initializes a social hybrid space platform by gathering all data necessary to perform multi-sensory real-time processing.

5.1.6 WebRTC sensorimotor channel (ALE)

A communication protocol to transport sensorimotor primitives with WebRTC standard.

5.2 COGNITIVE ARCHITECTURE

5.2.1 Actuation (of virtual human) (CRdC)

The act of using motion data computed by the cognitive architecture to animate virtual humans in the shared space.

5.2.2 Cognitive architecture (CRdC)

A set of algorithms, datasets, and feedback control strategies that a computer uses to determine the behaviour of a virtual human, say X, in the shared space. It can take as input recorded motion data from one or more humans, and past motion data generated by X and by other virtual humans. It outputs (parts of) the motion data to be followed by X. When deciding this motion data, the cognitive architecture follows an objective that depends on the level of autonomy.

5.2.3 Feedback strategy (CRdC)

A mathematical law used by the cognitive architecture to determine a motion signal or a quantity instrumental for the computation of the motion signal. The motion signal is changed in an intelligent and automatic way to fit within a motor signature and/or optimize specific metrics.

5.2.4 Metric (and Objective function) (CRdC)

A metric and an objective function are both mathematical functions that have as a codomain (i.e., the set of possible output values of the function) the set of real numbers, or a subset of it. It is used to assess the qualities of a motion signal.

An objective function is associated with the joint action goal of virtual humans interacting in the shared hybrid space and might be the composition of different metrics and/or other terms. In general, the closer the value of the objective function to a certain value or interval, the more the joint action goal is achieved.

5.2.5 Motor signal synchronization/coordination (CRdC)

A condition of alignment regarding the motion of two or more individuals and/or virtual humans, expressed as time signals. Namely, the motions are synchronized if all the signals are equal in time, except possibly for a small difference and/or a constant time delay.

5.2.6 Motor signature (CRdC)

A set of characteristics associated with the motion of a human that distinguishes their motion from that of other humans.

The motor signature can be expressed quantitatively by considering one or more specific motion tasks and giving the value of one or more metrics computed for the motion(s) performed in the task(s).

5.2.7 Motion collection (for a virtual human) (CRdC)

The act of measuring humans' motion signals in the physical space and/or collecting virtual humans' motion signals in the shared space and then sending this information to a cognitive architecture.

5.2.8 Virtual group (CRdC)

A set of two or more virtual humans in a shared space.

5.2.9 Virtual human's levels of autonomy ([L0,] L1, L2, L3) (CRdC)

An integer number between 1 and 3 (included). It quantifies how autonomous a virtual human character is.

- **L0**: a real human in a physical space.

- **L1**: The virtual human replicates the movement of a human, with the possibility of minor processing of its motion signals (e.g., noise filtering, compensation of time delays and losses of data packets).

- **L2**: The virtual human's movements are a modified version of a human's (e.g., change of amplitude and speed); the alteration is performed to achieve a specific goal while retaining resemblance to the human's original motion.

- **L3**: The virtual human's movements are the sole result of a computation by the cognitive architecture and not the unaltered or altered version of the motion of any single human and are performed with the objective to achieve a collective goal.

5.3 XR RENDERING AND ANIMATION

5.3.1 Autonomous Virtual Character (Golaem)

An Autonomous Virtual Character is an embodied autonomous agent. An embodied agent is an agent that interacts with other entities in a Social Hybrid Space through a physical body within that space. An autonomous agent is a system situated within and a part of a Social Hybrid Space that senses that space and acts on it, over time, in pursuit of its own agenda to affect what it senses in the future.

5.3.2 Avatar (Golaem)

An Avatar is a 3-dimensional character that represents a real Participant in the Social Hybrid Space. While it may not look the same as a Participant physically, the Avatar is usually based on the Participant's appearance and acts similarly in motion with him or her.

5.3.3 Biomechanics/kinematics (CYENS)

Biomechanics is the study of the mechanical principles that govern the structure, function, and motion of living organisms. Kinematics is the branch of classical mechanics that describes the motion of objects (position, trajectories, velocities, accelerations, etc.) without considering the underlying forces that cause motion. In biomechanics, kinematics is used to study the movement of biological systems (e.g., humans, animals) during physical activity.

5.3.4 Eyetracking and audio to facial expression mapping (Golaem)

Within SHARESPACE, as individuals will wear head mounted displays, it is not possible to track their facial expressions due to occlusions. We will then have at our disposal only the audio channel and the tracking of their eyes to animate the face of the Avatar that will represent a real participant in the Social Hybrid Space. Deep learning techniques will be used to learn how to animate the face from audio and eye tracking data.

5.3.5 Hyperrealistic representation (CYENS)

Hyperrealistic refers to a style of art or design that emphasizes the precise replication of reality in a manner that goes beyond mere realism. The aim of hyperrealism is to create an illusion of reality that is so convincing that it challenges the viewer's perception of what is real and what is not.

Hyperrealistic digital or virtual humans refers to the creation of virtual characters and/or avatars that are lifelike due to very detailed representations of appearance and motion.

5.3.6 Participant (Golaem)

A Participant is a real person immersed in the Social Hybrid Space and who collaborates with other Virtual Humans within this space through their L1 or L2 Virtual Human representation.

5.3.7 Posture/ human modelling (CYENS)

Human modelling is the process of creating the appearance and morphology of a digital representation of a human for use in a virtual space. Part of the process includes the creation of a skeletal rig to animate the character. Posture refers to the position and alignment of the body parts, such as the spine, shoulders, hips, and limbs, in relation to each other and to gravity. Part of the process includes the creation of a skeletal rig to animate the character. Posture refers to the position and alignment of the body parts, such as the spine, shoulders, hips, and limbs, in relation to each other and to gravity.

5.3.8 Scene neural rendering (CYENS)

Neural rendering is an emerging class of image and video generation approaches based on Deep Learning that enable control of scene properties such as illumination, camera parameters, pose, geometry, appearance, and semantic structure. It combines machine learning techniques with physical knowledge from computer graphics to obtain controllable and photo-realistic models of scenes.

Scene neural rendering approach (DFKI)

The approach focused on obtaining photo-realistic models of large-scale scenes with only limited control of scene properties, utilizing MSI for rendering.

5.3.9 Virtual Human (Golaem)

Virtual Humans are computer-based simulations of human beings. A Virtual Human can be (i) an Avatar, i.e., a representation of a Participant immersed in the Social Hybrid Space; (ii) a figurative virtual character in the Social Hybrid Space; (iii) an Autonomous Virtual Character interacting with the Participant(s) in the Social Hybrid Space.

5.3.10 Virtual human animation and style (CYENS)

Virtual Humans animation refers to how to simulate motion of real humans by computers in a virtual space. The animation style of a virtual human refers to the distinct movement features that it exhibits that distinguish it from another virtual human. These features are implicitly influenced by physiological (e.g., gender, age, fitness level) and psychological characteristics (e.g., mood, personality, etc.).

5.3.11 Virtual human post-synchronization (CYENS)

Post-synchronization (or dubbing) was initially introduced in the film industry to sync audio and film which were recorded separately. Post-synchronization of virtual humans is the synchronization of the audio, animation of body, face and hands after these data are recorded by different devices.

5.3.12 XR rendering and animation (CYENS)

XR rendering and animation refers to the rendering and animation of virtual objects in eXtended Reality (Virtual Reality/Augmented/Mixed Reality) devices such as head-mounted displays, caves, or mobile devices.

5.4 System Perception

5.4.1 3D digitization / 3D space reconstruction (RICOH)

3D digitization / 3D space reconstruction is a process by which a real-world 3D space with the corresponding content (boundaries, objects, and persons) is recorded within a digital domain by means of direct capture (direct point-cloud registration) or computationally reconstructed from a set of images (for example, using methods of photogrammetry).

5.4.2 Depth map (LIGHTSPACE)

A representation of either real or computer-generated 3D space as seen from a view-port or camera. A dataset holding information about distances of points in a field of view.

5.4.3 Ego-centric visual-inertial tracking (DFKI)

Ego-centric visual-inertial human body tracking is a technique used to estimate the position and orientation of human body segments via a combination of visual and inertial sensors. In this approach, the camera is mounted on the human body (ego-centric perspective).

5.4.4 Eye-tracking (RICOH)

Eye-tracking, sometimes referred to as gaze tracking, encompasses a process of real-time registration of a gaze direction or in a more general sense – registration of eye movement activity.

5.4.5 Fisheye image (RICOH)

A fisheye image is an ultra-wide-angle image covering a field of view of, typically more than 100 degrees (often surpassing 180-degree FOV) captured with a special type of lens called a fisheye lens. Due to the optical construction of a lens, an obtained fisheye image without processing steps is non-rectilinear.

5.4.6 Focal plane (LIGHTSPACE)

In the context of extended reality displays focal plane is understood as an imaginary (virtual) screen plane - a source from which virtual image rays are emitted. Alternatively, it can be understood as a plane at which a viewer has to focus (accommodate) the eye to observe a sharp virtual image. The distance at which a viewer must focus (accommodate) eyes is referred to as a focal distance. It is not to be confused with the placement of a virtual screen in a 3D space, which is defined through binocular disparity. Synonyms include Virtual image plane and the Image depth plane.

5.4.7 Focal rivalry (LIGHTSPACE)

A focal rivalry is an effect attributed to optically see-through (or Augmented Reality) displays, in which the distance of a display's focal plane is substantially different from a real-world object that is digitally augmented. In such cases, it becomes impossible to perceive the real-world object and the corresponding digital image simultaneously in focus (sharp). Due to conflicting focus cues, spatial confusion in the form of an inability to correctly assess distances can occur.

5.4.8 Focus cues (LIGHTSPACE)

Focus cues are depth information sources utilized by the visual system to form a sense of 3D depth. Accommodation (eye-focus) and gradient retinal blur are among common focus cues perceived in the natural world. With respect to digital displays, these cues typically cannot be conveyed truthfully, except for certain next-gen display technologies which can, to a certain degree, imitate these depth cues. Correct or near-correct focus cues are an integral part of overcoming vergence-accommodation conflict and focal rivalry.

5.4.9 Movement primitives (DFKI)

Movement primitives are fundamental building blocks of a kinematic chain model sequence that can be used to describe kinematic movements or generate kinematic movements, e.g., for avatars. Movement primitives are a common group for policy representation in robotics. These motion primitives can be derived from a collection of movements and can be re-combined to produce or to describe more complex actions like walking, running, or dancing. They can also be re-combined and adapted to generate movement sequences, via a movement primitive library.

5.4.10 Movement Primitives Library (DFKI)

A movement primitives library consists of a minimal set of movement primitives sufficient for reconstructing a larger set of complex movements without or with a minimal loss of information.

5.4.11 Multi-focal display (LIGHTSPACE)

A multi-focal display is a display having more than one focal plane. From a viewer's perspective a multi-focal display conveys multiple focal or image depth planes simultaneously, though technically it can be realized, for example, through fast-paced time-sequential scan out. In the context of stereoscopic 3D displays, multi-focal display architecture mitigates or solves vergence-accommodation conflict, while in optically see-through mode (Augmented Reality) it additionally mitigates or overcomes focal rivalry. Multi-focal displays require accordingly rendered and presented 3D content to leverage gains of focus cues.

5.4.12 MSI (Multi-Sphere Images) (DFKI)

A set of images, that represent concentric spheres of increasing radii. Each sphere represents a discretization of the volume at its distance from the centre. MSI are rendered through a volume rendering approach. We use MSI as part of our Scene Neural Rendering approach.

5.4.13 Multimodal-multisensory system perception (DFKI)

Multimodal-multisensory system perception refers to the ability to capture and integrate information from various sensory modalities (e.g., vision system, inertial system, sound systems, etc.) to perceive and interpret the environment by a machine. Multimodal-multisensory system perception can improve accuracy and reliability by integrating information from complementary information/sensor sources, allowing more reliable perception and understanding of the environment.

5.4.14 Occlusion (RICOH)

Occlusion in a 3D space is an effect when from a given perspective of a viewer or, for example, camera an object fully or partially blocks information about another object that is behind it. This can interfere with 3D space scanning modalities.

5.4.15 Point cloud (RICOH)

A point cloud is a basic format for representing a large number of 3D spatial measurements. These points represent the X, Y, and Z geometric coordinates and an attribute – for example – RGB colours of a single spatial point. It must be noted that point clouds can represent surface (occlusion susceptible), as well as volume when recorded in a particular modality.

5.4.16 RGB spherical(360°) camera (RICOH)

RGB spherical camera is a type of camera/camera system that is capable of capturing a 360-degree view of its surroundings, creating a fully immersive, panoramic image or video.

5.4.17 Registration / Recording alignment (RICOH)

Recording alignment is the process of reconstructing a whole scene by combining point clouds acquired at different shooting positions and within a limited range. It is impossible to obtain all the point cloud data of an object or a scene at once because the Field of View (FoV) and the measurement range of a depth camera usually are not sufficient to capture the massive scene and complete the occlusion in the scene. The technology that makes several point clouds fuse into a complete point cloud with a common coordinate system is called point cloud registration, which is to calculate the transformation (translational and rotational) between point clouds to transfer these point clouds into a common mapping coordinate system.

5.4.18 Representation for movement encoding/decoding (DFKI)

Unsupervised or semi-supervised machine learning approaches for dimensionality reduction of sequential input data, such as high dimensional movement kinematics.

5.4.19 Time-of-Flight RGBD (depth) spherical (360°) camera (RICOH)

Time-of-Flight RGBD spherical camera is a type of camera that can capture both colour (RGB) and depth (D) information simultaneously, allowing for 3D mapping and measurement of its surroundings. This camera uses a technique called time-of-flight (TOF) to measure the distance between the camera and objects in its field of view. In addition to capturing colour and depth, this camera is also spherical, meaning it can capture a 360-degree view of its surroundings.

5.4.20 Time-of-Flight camera (RICOH)

Time-of-Flight (ToF) camera is a non-contact ranging system that measures the distance between the camera/camera system and the target object by emitting light and measuring the time to bounce back. A ToF camera is one of the go-to tools for capturing direct depth maps of 3D space.

5.4.21 Single focal plane display (LIGHTSPACE)

A single focal plane display is a display (for example a stereoscopic head-mounted display) having a single focal plane. While in the case of stereoscopic displays each eye could be provided with a separate optical assembly to form a virtual image - in such displays focal distance of corresponding left and right focal planes would be matched. In the most widespread understanding - a single focal plane display has a fixed focal plane - meaning the focal distance is fixed in the optical design. For example, typically, the focal plane in a single focal plane display is located at distances of 1.5 meters to infinity. Nonetheless, deviations in special cases are possible.

5.4.22 Varifocal display (LIGHTSPACE)

A varifocal display is a single focal plane display, in which the position (distance) of the focal plane can be changed. Furthermore, with respect to stereoscopic 3D displays, varifocal display architecture is coupled with a gaze or eye position tracking system to estimate the eye vergence angle and to match the distance of a focal plane to a viewer's vergence distance in a given instant of time - thus overcoming vergence-accommodation conflict and respective negative effects. Nonetheless, varifocal displays do not convey natural focus cues and for realism must rely on computationally synthesized defocus. When implemented in optically see-through stereoscopic displays - varifocal architecture can address focal rivalry.

5.4.23 Vergence-Accommodation Conflict (LIGHTSPACE)

Vergence-accommodation conflict is a phenomenon attributed to stereoscopic displays - most prominently to single focal plane displays, in which the natural coupling of eye vergence and accommodation (focus) becomes broken - requiring the brain to perceive mismatched vergence and accommodation cues, typically accompanied by visual discomfort and fatigue. Typically, the phenomenon manifests when a virtual object is positioned in the 3D space by means of binocular disparity at a distance that is substantially different from that of a focal plane of the display device - requiring a user to verge to a virtual object as defined by binocular disparity while simultaneously accommodating at the actual focus plane (to observe a sharp image of the object).

5.5 EU – XR4EUROPE

5.5.1 Augmented reality - AR

Augmenting the perception of the real environment with virtual elements by mixing in real-time spatially-registered digital content with the real world. Pokémon Go and Snapchat filters are commonplace examples of this kind of technology used with smartphones or tablets. AR is also widely used in the industry sector, where workers can wear AR glasses to get support during assembly, maintenance, or for training.

5.5.2 Extended Reality - XR

It is the umbrella term used for Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), as well as future realities immersive technologies might create. XR covers the full spectrum of real and virtual environments.

5.5.3 Mixed Reality - MR

This term includes both AR and AV. It blends real and virtual worlds to create complex environments, where physical and digital elements can interact in real-time. It is defined as a continuum between the real and the virtual environments but excludes both.

5.5.4 Virtual reality - VR

Applications use headsets to fully immerse users in a computer-simulated reality. These headsets generate realistic images and sounds, engaging two senses to create an interactive virtual world. aimed at improving the feeling of embodiment.

5.6 SHARESPACE ETHICS

5.6.1 Attachment (DMU)

In the ethics of technology, attachment refers to the emotional connection humans may have with technical objects. Differs from its meaning in developmental psychology (attachment theory), and is closer to theories of attachment drawn from marketing and advertising.

5.6.2 Authenticity (DMU)

Authentic means to be true and real in one's life, feelings and behaviours.

5.6.3 Autonomy (DMU)

Autonomy in ethics is a 'state or condition of self-governance, or leading one's life according to reasons, values, or desires that are authentically one's own.' Etymologically from Greek autos meaning self and nomos meaning rule (Briannica.com). Autonomy is in many ways the guiding normative principle of liberal democratic societies. It is because we think individuals can and should govern themselves that we value our capacity to collectively and democratically self-govern.

5.6.4 Deception (DMU)

Misleading and presenting someone or something in a way that is false, often to bring about effects in users, to bolster the importance of a technological artifact.

5.6.5 Distributive Justice (DMU)

The means by which resources are shared or distributed in a society. The means by which fairness, equality and justice are organised in computerised systems.

5.6.6 Ethics by Design (DMU)

The process of including ethics in all design phases of the technological process. Or "Ethics by Design concerns the methods, algorithms and tools needed to endow autonomous agents with the capability to reason about the ethical aspects of their decisions and the methods, tools and formalisms to guarantee that an agent’s behaviour remains within given moral bounds”.

5.6.7 Ethics of Care (DMU)
The value of human interpersonal relations. The prioritizing of relationships between people and their well-being in technological design and development.

5.6.8 Harm (DMU)
Recognizable detrimental effects on humans, nonhuman animals, or the environment. Typically is a legal term that is measurable. Harm is an effect of a technology mitigated by regulation or identified via ethical analysis.

5.6.9 Human Dignity (DMU)
The worth of human beings. Their rank or place among other living beings.

5.6.10 Humanistic Principles (DMU)
Values associated with the rise of democratic European states. Principles guiding states and individuals. Ethics of governance of state and individual within legally proscribed limits e.g., freedom of speech, freedom of association.

5.6.11 Privacy and Data Protection (DMU)
The right to live one's life free from state or external interference. The right to conceal or disclose information about one's self to others. In computerised mediated data driven economies, it includes a right protected in European law (GDPR). The right to be forgotten, or opt out. The right to have one's data processed in legal ways, the right to have data destroyed, or to be corrected if erroneous.

5.6.12 Trust (DMU)
Trust is a belief in the truth and honestness of others, organisations, institutions, artificial agents.

5.7 SHARESPACE SOUND

5.7.1 Acoustic invariant (IMT)
Ubiquitous relationship (or lawful relation) between properties of objects, for instance size, shape, density, and their sounds.

5.7.2 Everyday Listening (IMT)
The act of gaining information about events in the world by listening to the sounds they make, could provide opportunities for action.

5.7.3 Sonic Interactions (IMT)
In virtual environments, sonic interaction refers to human-computer interplay through auditory feedback in 3D environments.

5.7.4 Sonification (IMT)
Sonification is the use of non-speech audio to convey information or perceptualize data. For example, a sonification process could be applied to movement to perceive the amplitude or the speed of the movement from an auditory perspective.

5.7.5 Sound event (IMT)
A sound event is a label describing a recognizable sound or sound sequence. Sound events can be used to represent a scene in a symbolic way, e.g., an auditory scene on a busy street contains events of passing cars, car horns and footsteps of people rushing.

5.7.6 Soundscape (IMT)
Acoustic environment as perceived by humans, in a certain context.

5.8 SHARESPACE FOR ART

5.8.1 Artistic remote participation (AE)
Artistic remote participation is the involvement of individuals or groups in artistic activities, performances, or exhibitions, without being physically present.

5.8.2 Hybrid Co-location (AE)
Commonly, co-location means that multiple people are in the same physical space. In the context of a Shared Hybrid Space co-location applies to Participants who are in the same physical and virtual space (e.g., artistic use cases in Deep Space 8K), or maybe in the same virtual space as remote users but, naturally, do not share the physical space.

5.8.3 Collaborative Aesthetics (AE)
Collaborative Aesthetics (CA) builds upon the term Cooperative Aesthetics, defined by media art expert Gerhard Funk. It describes an interactive yet creative process of unique shared experiences in an immersive environment. CA empowers every user to actively contribute their ideas and perspectives within a shared space. Together, the group, influencing each other and depending on each other's actions, creates a new system of interconnected participants. The product of their interactions generates a unique outcome during their experience. This can be an audio-visual art piece, a collective narrative and many more.

5.9 SHARESPACE FOR HEALTH

5.9.1 Acceptability of the intervention (UJI) (VHIR)
Perception among stakeholders that a given evidence-based practice is useful or satisfactory.

5.9.2 Addiction to technology (UJI)

Obsessive, frequent behaviour toward technology despite its negative impact on the person, is typically marked by increased arousal and withdrawal symptoms if the item is removed.

5.9.3 Appropriateness (of an intervention) (UJI)

Analysis of perceived fit, relevance, or compatibility of an intervention in a given context (e.g., hospital, community setting, or at home). The evaluation of Appropriateness can be carried out before the intervention is implemented or once there is some evidence of its use.

5.9.4 Cost of a technology (perceived) (UJI)

Concerns associated with the costs of purchasing the necessary equipment to use technology.

5.9.5 Cultural embodiment (UJI)

One's perception of belonging to the culture is represented within the virtual world.

5.9.6 Cybersickness (UJI)

Typically occurs during or after immersion in a virtual environment. A form of motion or simulator sickness related to sensory mismatch. The symptoms include dizziness, nausea, postural instability, and eye fatigue.

5.9.7 Demographics (UJI)

Statistical expression of the socioeconomic characteristics of a person or human population, including age, sex/gender, educational level, employment status, income, and marital status, among others.

5.9.8 Ease of use of technology (perceived) (UJI)

The extent to which a person believes that using technology is free of effort.

5.9.9 Ecological Validity of a technology (perceived) (UJI)

Sense of believability and realism of the virtual environment.

5.9.10 Efficacy (of an intervention) (UJI)

The success rate of an intervention if implemented as in guidelines; is defined as positive outcomes minus negative outcomes.

5.9.11 Fatigue (UJI)

Extreme tiredness, exhaustion, or weakness and inability to perform as a result of energy loss.

5.9.12 Feasibility (of an intervention) (UJI)

The extent to which an evidence-based practice can be successfully used or conducted by a participant within a given context.

5.9.13 Fidelity (of an intervention) (UJI)

The extent to which the intervention is implemented as intended once it is implemented in daily practices or routine care.

5.9.14 Implementation cost (of an intervention) (UJI)

Costs associated with implementing evidence-based practice.

5.9.15 Improved functionality of an individual (thanks to the technology) (VHIR)

Patients' enhanced ability to perform daily activities, fulfil usual roles and maintain their health and well-being thanks to the inclusion of technology.

5.9.16 Intention to use technology (UJI)

User's desire and willingness to use technology in the future.

5.9.17 Kinesiophobia (UJI)

Excessive and irrational fear of movement or physical activity.

5.9.18 Mimicry (in human behavioural contexts) (UJI)

Unconscious, spontaneous, automatic, an immediate imitation of another person's behaviour, such as gestures, postures, and mannerisms.

5.9.19 Pain (UJI)

Distressing experience associated with actual or potential tissue damage with sensory, emotional, cognitive, and social components.

5.9.20 Pain modulation (VHIR)

The process of alterations in the pain signals as it is transmitted along the pain pathway, which explains why patients respond to the same painful stimulus in different ways.

5.9.21 Pain unlearning (VHIR)

Pain can be a conditioned response, or learned behaviour, rather than only a physical problem. The behaviour usually begins purely in response to the presence of an injury, and then it is reinforced and becomes a conditioned response. Pain unlearning consists of modifying these learned experiences and re-educating the experience of pain to improve the patient's well-being.

5.9.22 Patient empowerment (VHIR)

A process of encouraging greater self-control in the patient over decisions and actions affecting their health.

5.9.23 Penetration (of an intervention) (UJI)
The extent to which an evidence-based practice can be integrated within an organization and its subsystems.

5.9.24 Virtual presence (perceived) (UJI)
Sense of being “there” within a virtual environment.

5.9.25 Reach (of an intervention) (UJI)
The proportion of the target population that can participate in an intervention or proposed treatment.

5.9.26 Self-efficacy (toward pain management) (UJI)
Set of beliefs that people have over their capacities, about their ability to perform certain tasks despite the pain or their ability to modulate their pain.

5.9.27 Self-efficacy to use a technology (perceived) (UJI)
The perception that an individual has the competence to use technology.

5.9.28 Social connectedness within a virtual world (UJI)
The subjective feeling of inclusion or acceptance into a group of (virtual) people.

5.9.29 Social exercise (VHIR)
Exercising while interacting with other patients with similar conditions, which has been shown to produce benefits in overall health status.

5.9.30 Social presence of a technology (perceived) (UJI)
Sense of being with another person (within a virtual world).

5.9.31 Technostress (UJI)
Negative psychological impact of working with technology.

5.9.32 Usefulness of a technology (perceived) (UJI)
Extent to which a person believes that using a technology will improve their daily functioning and well-being.

5.9.33 Virtual pills (VHIR)
Short and focused interventions based on virtual reality to address a specific problem occurring in the patient.

5.10 SHARESPACE FOR SPORT

5.10.1 Human modelling (INRIA)

Digital human modelling is the way to represent a human as a digital entity. It concerns the graphic representation of these humans, their appearance, but also and especially the representation of their structure, their skeleton. Indeed, humans have more than 200 bones and 600 muscles and human modelling allows us to simplify this musculoskeletal structure in a representation that can be simulated and animated. It can be modelled by many representations: absolute, relative, normalized... This representation is used to animate virtual characters. Its parameters are also used as motion body cues for perceptual analysis or as performance factors for biomechanical analysis.

5.10.2 Posture (INRIA)

A posture is defined by a particular configuration of body segments in relation to each other at a given time. It can be modelled by many representations (see human modelling).

5.10.3 Sport for health (INRIA)

The term sport for health is used when the objective of physical activity is to improve the quality of life, well-being or to accompany the fight against diseases. It is often opposed to the term sport performance, whose objective is to improve athletic performance.

5.10.4 Sport performance (INRIA)

The term sport performance is used when physical activity is done for athletic performance purposes, whether it is by high-level athletes to achieve excellence or by individuals who practice to improve their abilities. It is often contrasted with the term sport for health, whose objective is to maintain a healthy lifestyle and quality of life.

5.10.5 Visual cues (INRIA)

Visual cues are visible hints that provide someone with information about how to do an activity, behaviour, or skill.

5.11 SOCIAL SENSORIMOTOR INFORMATION

5.11.1 Amplification (UKE)

Amplification of sensorimotor primitives encoding social information to facilitate the readout of such information by human interactants. One of the principles guiding the reconstruction of sensorimotor primitives in SHARESPACE.

5.11.2 Information transmission (UKE)

The process of transmitting information through movement kinematics; transmitted information is operationalized by the measure of intersection information and can be modulated by feature amplification/attenuation.

5.11.3 Intersection information (UKE)

The amount of information encoded in kinematics that is read out by human perceivers to inform their behavioural response (Patri et al., 2020; Becchio et al., 2021; Montobbio et al., 2022).

5.11.4 Kinematic coding (UKE)

Coding of information in movement kinematics; it involves two crucial stages: kinematic encoding and kinematic readout. Kinematic encoding refers to how information is encoded (specified) in movement kinematics during action execution. Kinematic readout refers to how encoded information is read out by human perceivers during action observation (Patri et al., 2020; Becchio et al., 2021; Montobbio et al., 2022).

5.11.5 Reconstruction (UKE)

The process of reconstructing sensorimotor primitives in the social hybrid space as opposed to simply reproducing movement kinematics.

5.11.6 Sense of Agency (UKE)

The psychological experience of control over one’s own intentional actions and their consequences; can be extended to incorporate the notion of feeling responsible for the actions of one’s body.

5.11.7 Sense of Ownership (UKE)

The feeling of possession toward one’s own body parts, feelings, or thoughts.

5.11.8 Sensorimotor primitive (UKE)

The building component of bodily actions by intentional agents, consists of coordinated kinematic variables, dynamic variables, and sensory variables.

5.11.9 Social information (UKE)

The information encoded in sensorimotor primitives, including information about intentions, emotions, subjective feelings.

5.11.10 xBodiment (UKE)

Pre-reflective experience combining sense of self-location in the X-space (i.e., I am located where my L1/L2 avatar is located), sense of agency (i.e., I am in control of the actions of my L1/L2 avatar), and sense of ownership (i.e., L1/L2 body is my body).

5.11.11 xSelf-Identity (UKE)

Immediate, pre-reflective experience of selfhood in XR-Space.

5.12 SOCIAL SENSORIMOTOR PROPAGATION

5.12.1 Attenuation (UM)

Attenuation of a sensorimotor primitive is a transformation of the signal to reduce the intensity of the social information encoded by the Virtual Human (specified as a constellation of the motion primitives - amplitude, speed, and angle of the movement) transferred to the Shared Hybrid Space.

Attenuation can be computed as a difference between the original motion primitive captured in L0 (or extracted from the motion library for L3) and the primitive rendered in the Shared Hybrid Space. A higher attenuation value will mean a greater reduction in the social information for readout.

5.12.2 Embodied leadership (UM)

Embodied leadership refers to a leadership approach that emphasizes the integration of gestures and movements in group dynamics. It is based on the understanding that human cognition and decision-making are grounded in bodily experiences and sensori-motor communication, rather than purely mental and intellectual processes. Two types of embodied leadership co-exist: (i) Phase leadership, corresponding to a particular position of the leader in the group and (ii) influence leadership, corresponding to the most influential member(s) in the group and captured by causality metrics (e.g., Granger causality, Causation Entropy).

5.12.3 Extended motivation (UM)

Sustainable affiliation and achievement motivations are fuelled by self-esteem as well as feelings of relatedness and competence promoted by XR technologies.

5.12.4 Extended multisensory perception (UM)

Multisensory perception has several definitions. Here we define it in the context of the ecological approach to perception and action (Gibson, 1979), as the detection by our perceptual systems of the invariant relations specified in the Global Array, i.e., the spatiotemporal structure created by our interaction with the environment that extends across multiple forms of ambient energy (Stoffregen & Bardy, 2001). In Extended Reality environments, the status of our interaction continues to be specified in the Global Array, and we continue to detect it, however through novel relations across individual energy arrays not experienced before.

5.12.5 Hybrid cohesion (UM)

Sense of social connectedness between Participants, Avatars, and Autonomous Virtual Characters, who aim to work together towards a shared activity goal. Agents trust and respect each other, and are attracted to and identify with the group they build together, whilst recognising possible differences.

5.12.6 Inter-agent typology (UM)

Humans often cooperate in small or large ensembles, for instance through behavioural synchronization in space and time. Synchronization requires group members to be coupled together, usually through (visual, acoustic, or haptic) perception. Inter-agent typology refers to the type of spatial configuration that affects the strength and symmetry of perceptual coupling, for instance when agents are facing each other in a circle (everyone can see everyone) or in a line, such as during team rowing (everyone sees only a small number of individuals) (e.g., Alderisio et al., 2017).

5.12.7 Social hybrid presence (UM)

Sense that the experiences rendered in the Shared Hybrid Space are authentic (other Virtual Humans collocated in the same environment as the user are volitional) and that users feel connected to/ agentic of their virtual representation (within layers of body, emotion, identity) in the

Shared Hybrid Space. Social hybrid presence encompasses both mental and physical sense of 'being' in Shared Hybrid Space anchored in a current moment.

5.12.8 Social sensorimotor propagation (UM)

Transmission and entrainment of social information (coded in sensorimotor primitives) across Virtual Humans interacting and perceiving in Shared Hybrid Space. The degree of propagation can be defined by the increase in the amount of social information encoded by a Virtual Human (with low or no social information load at baseline) after interacting with another Virtual Human (with a high social information load prior to the interaction).

5.12.9 Specification in hybrid environments (UM)

In general, specification refers to a physical-lawful, 1:1 relation between patterns of sensory stimulation and the physics of the agent-environment interaction that gives rise to them (e.g., Gibson, 1979; Stoffregen & Bardy, 2001). This lawful relation constitutes information, which can be detected by our perceptual systems. In hybrid environments, specification continues to exist, however through novel relations between sensory patterns and the new physics of the interaction between the agent and the hybrid environment.

6 CONCLUSIONS AND FUTURE DIRECTIONS

This deliverable presents the first version of the SHARESPACE glossary, in the form of the main terms from our disciplines. We considered it important to characterize social sensorimotor interactions in XR or shared hybrid spaces, organized into 5 possible backbones that are still being compared and confronted. The data collected illustrate the richness of our consortium and its various domains of expertise and constitute a first step toward a common vision underlying ethical, inclusive, embodied social interaction in hybrid space. Obviously, this work is unfinished at this stage and will see several iterations of the glossary during the lifetime of the project. Specifically, the next steps aimed at achieving:

- A single structure of the glossary validated by all partners (M9-M10).
- A selection and revision of key SHARESPACE-specific terms (around 25), identified among the 135 listed terms, that characterize innovative embodied social interactions in XR (M10-M12).
- The submission of the SHARESPACE glossary to a relevant journal (M12-M14).
- Periodic revisions as necessary will be triggered until the end of the project.

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