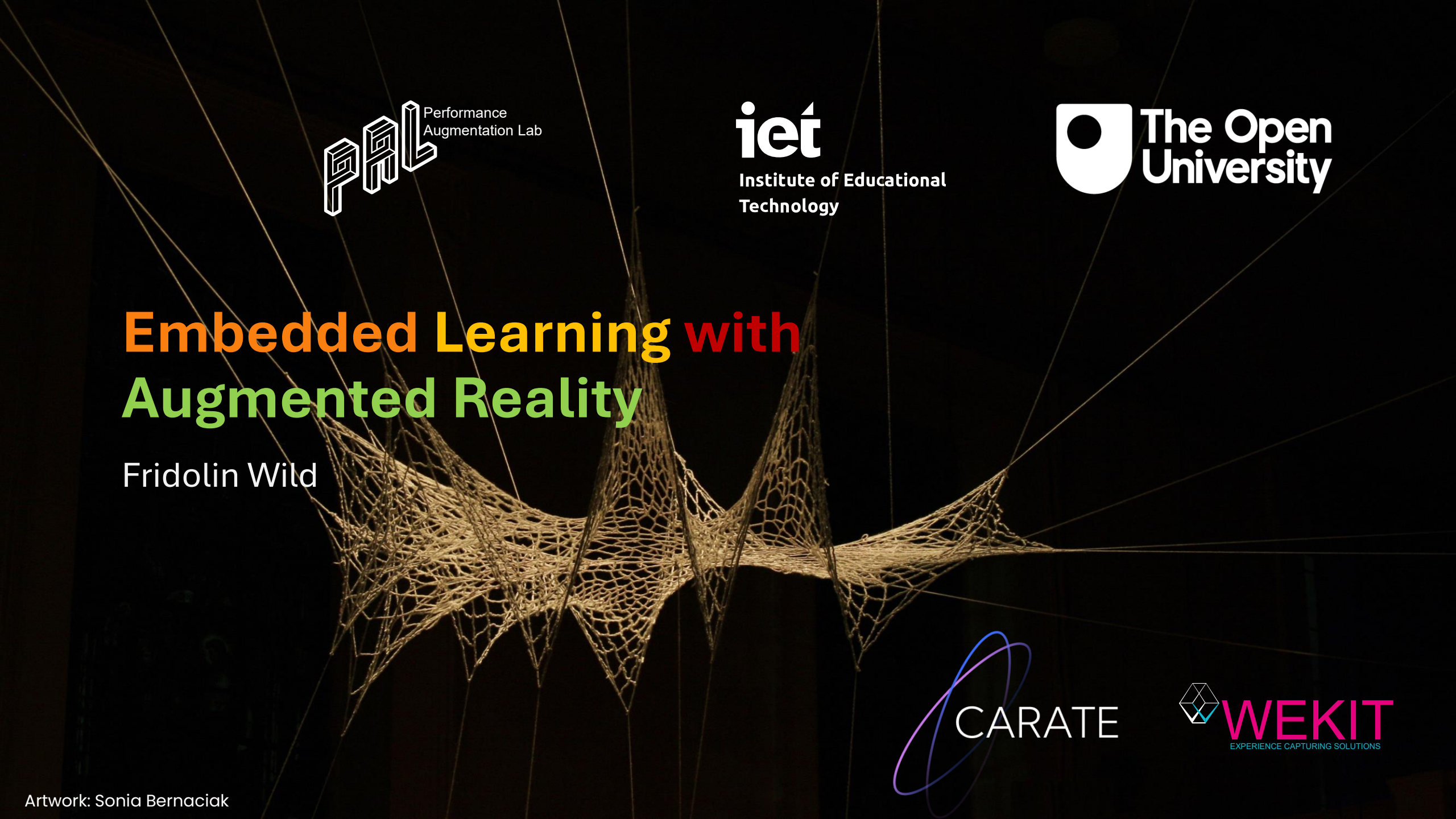

Performance
Augmentation Lab
iet
Institute of Educational
Technology
The Open
University
Embedded Learning with
Augmented Reality
Fridolin Wild
CARATE
WEKIT
EXPERIENCE CAPTURING SOLUTIONS
Artwork: Sonia Bernaciak

PLAN

My Lab in IET

The Big Picture

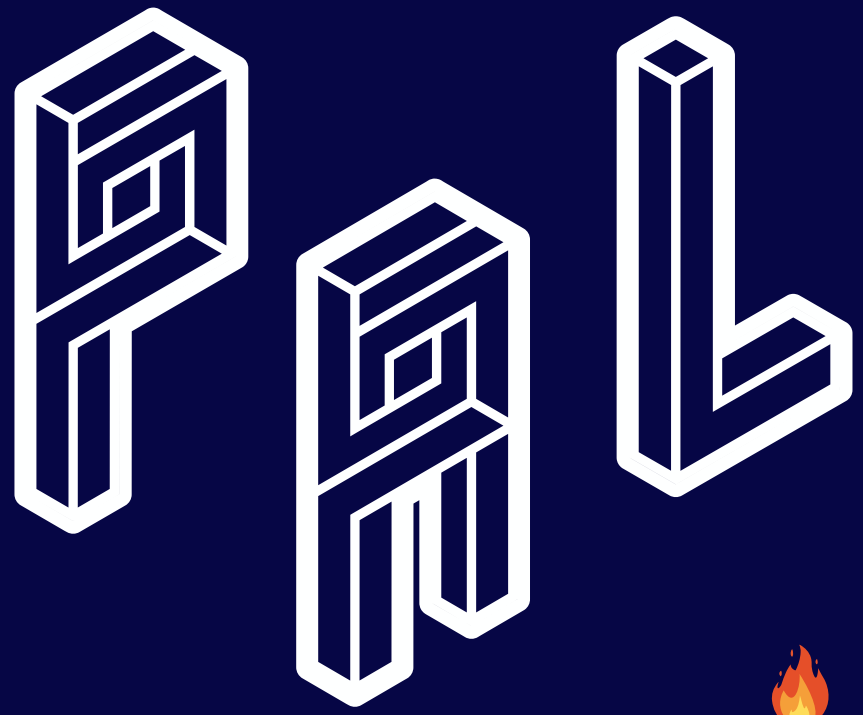
Embedded Learning

(Some) Achievements

Outlook and To-Do’s

The Open University

Performance Augmentation seeks to bridge the dissociative gap between abstract knowledge and its practical application, researching radically new methods to connect knowing something ‘in principle’ to applying that knowledge ‘in practice’.



Inception in **The Bazaar**.

Prototyping in **The Lab**.

Validation in **Innovation Pilots**.

EdTech Ignite

CARATE

WEKIT
EXPERIENCE CAPTURING SOLUTIONS

LooselyToons

Goggleminds

“Almost **40 percent** of global employment is exposed to AI“

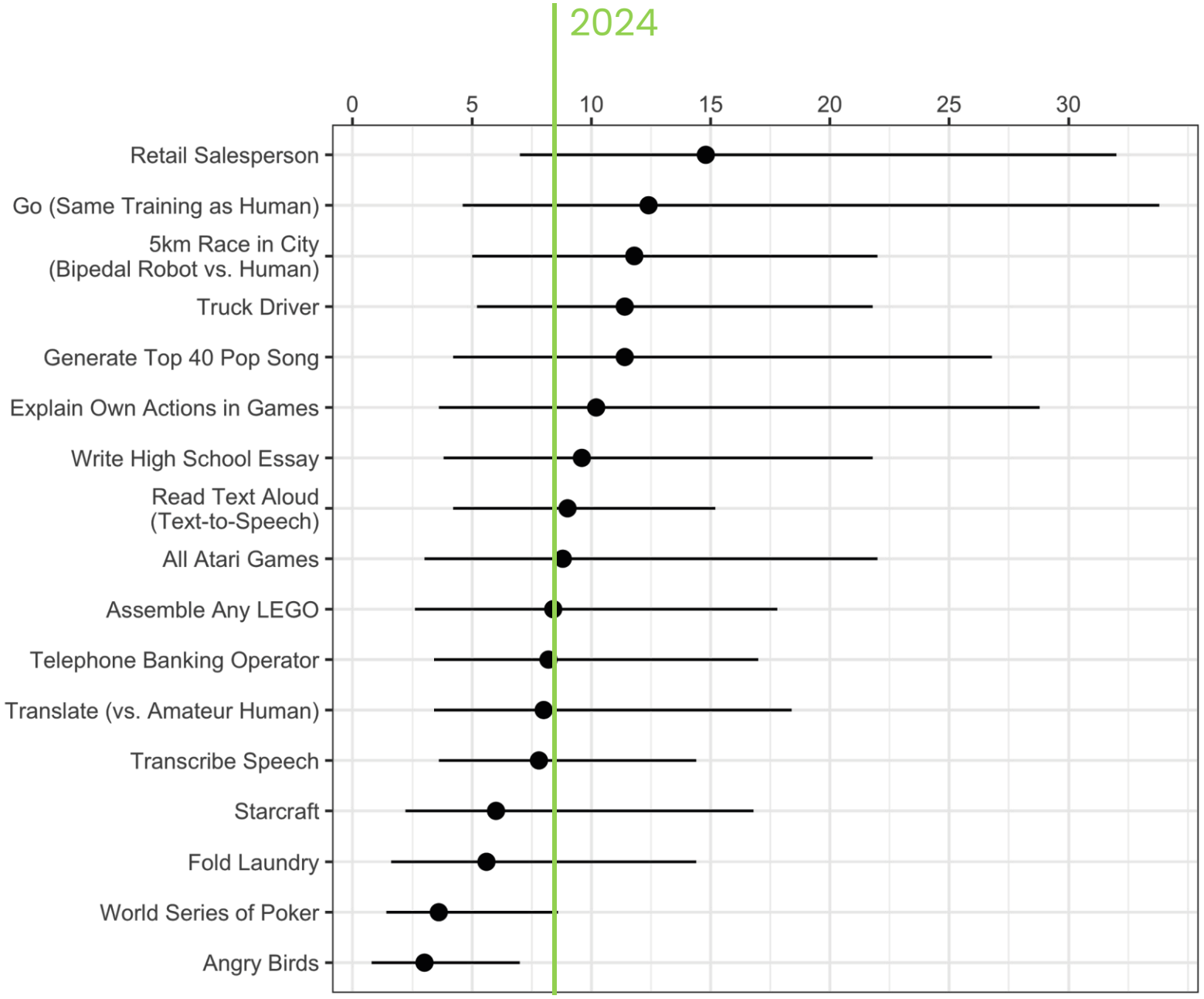
“Model simulations suggest that, with high complementarity, higher-wage earners can expect a more-than-proportional increase in their labor income, leading to an increase in labor income inequality.”

– IMF, 2024

The Open University

Grace, Salvatier, Dafoe, Zhang, Evans (2017)

When will AI exceed human performance?



of organisations are currently facing skills shortages. This rises to **86%** of large organisations.

of organisations say they have been prevented from filling roles due to lack of applicants.

of organisations say skills shortages have increased workload on existing staff.

of large organisations have implemented a plan relating to recruitment, their workforce or their wider impact. This compares to only **45%** of micro firms with fewer than 10 employees.

of organisations say they don't have initiatives, skills programmes, or adjustments for specific talent pools, including underrepresented groups. This rises to **65%** of micro organisations.

of organisations have seen a net change in the number of employees over the age of 50 in the last three years.

British Chambers of Commerce

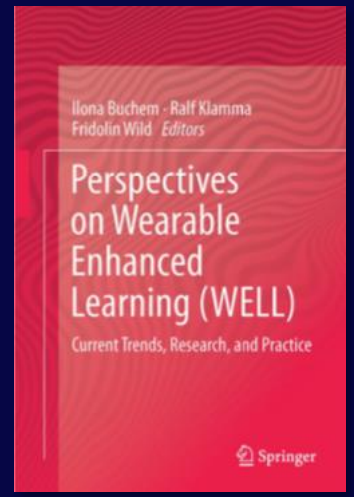
The Open University

Business Barometer

June 2023

The Open University

Ages of Learning Technology



	EDTECH 1.0	EDTECH 2.0	EDTECH 3.0	EDTECH 4.0
innovation:	**DIGITIZED**	**MANAGED**	**INDIVIDUALIZED**	**EMBEDDED**
technology:	email, file transfer	web	web, apps, ebooks	XR, AR, VR, MR
standards:	MIME, FTP, HTTP	SCORM, LOM, DC	LD, WIDGETS, CC/LTI	ARLEM, XAPI
devices:	terminal, pool PC	PC, laptop	mobile, tablet	glasses, mobile, e-textile
systems:	mail/ftp client, browser	LMS	PLE, LA, apps	Spaces, Metaverse

01

Mobile Computing

Wearable Computing

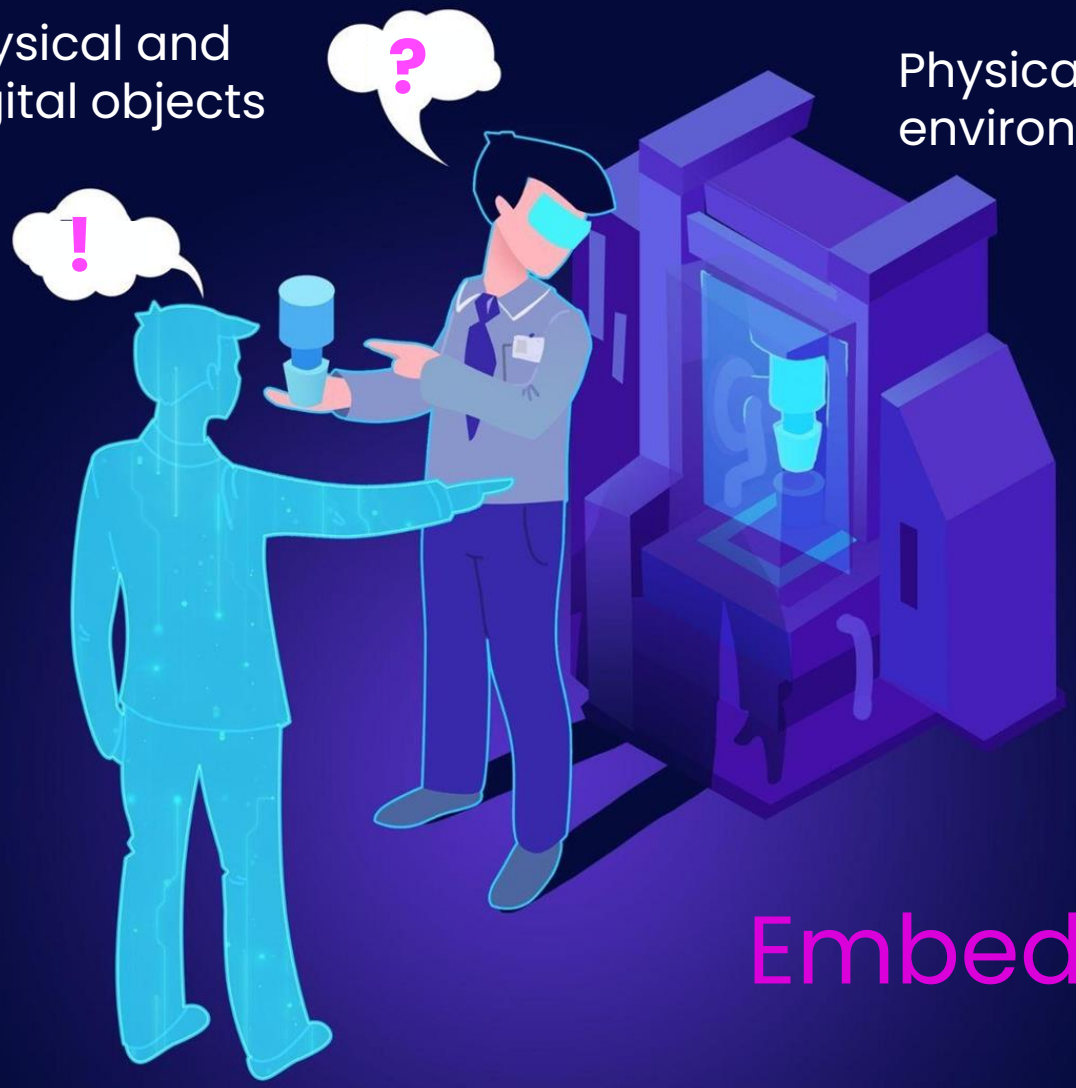
Physical and digital objects

Physical environment

Hologram Digital Twin

AI Instructors

Remote Peers and MKO



Embedded Learning

Premise of embedded learning

= dissociative gap between knowledge and its practical application

Actively (co-)design memorable experience

Facilitate self-determination

Support serendipity and exploratory discovery

Embedded vs traditional learning

- Cued recall
- Context
- Multiple perspectives
- Multiple representations
- Memory palace
- Spatial cognition, participation oriented
- Learning by experience, learning by doing
- Embedded in practice

- Model based
- Explicit
- Comprehensive and absolute
- Single best representation
- Frame of reference
- Multimedia, communication oriented
- Learning by conversation, multimedia learning
- Dedicated learning space

- Space is a pretty **extreme environment**
- Astronaut training of globally dispersed teams in classic mode takes **too long**
- Ground support from Earth **not available** or only available at specific timeframes

➔ More flexibility and autonomy needed
➔ Real-time support for joint crew training and joint authoring is needed
➔ Enterprise-grade ‘embedded learning’ analytics needed (for predictive capability development)

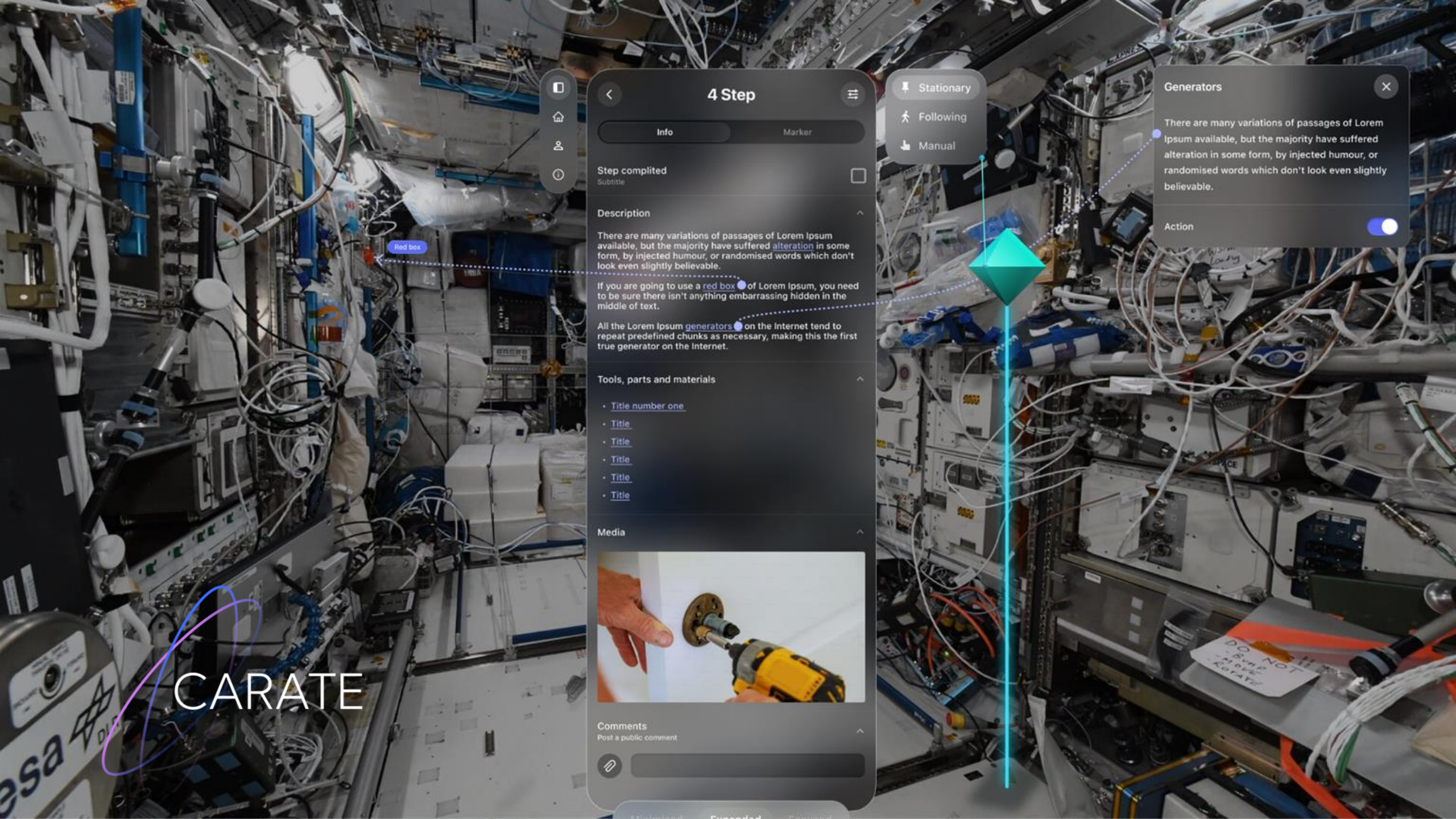
CARATE

XR2LEARN

ALTEC

WEKIT
EXPERIENCE CAPTURING SOLUTIONS

Add character
Activities
Profile
Help
Ready Player Me
Libraries
Ready Player Me 1
16 kb
Ready Player Me
16 kb
Ready Player Me 3
12 kb
Ready Player Me 4
46 kb
Add new
CARATE

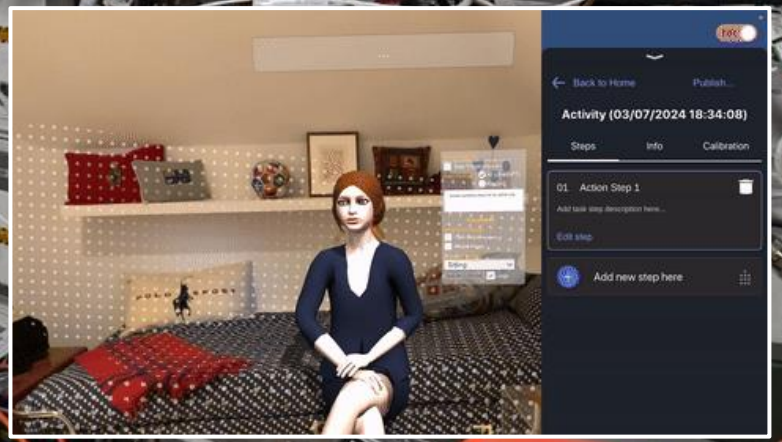

4 Step
Info
Marker
Step complited
Subtitle
Description
There are many variations of passages of Lorem Ipsum available, but the majority have suffered alteration in some form, by injected humour, or randomised words which don't look even slightly believable.
If you are going to use a red box of Lorem Ipsum, you need to be sure there isn't anything embarrassing hidden in the middle of text.
All the Lorem Ipsum generators on the Internet tend to repeat predefined chunks as necessary, making this the first true generator on the Internet.
Tools, parts and materials
Title number one
Title
Title
Title
Title
Title
Media
Comments
Post a public comment
Red box
Stationary
Following
Manual
Generators
There are many variations of passages of Lorem Ipsum available, but the majority have suffered alteration in some form, by injected humour, or randomised words which don't look even slightly believable.
Action
CARATE

Development Insights

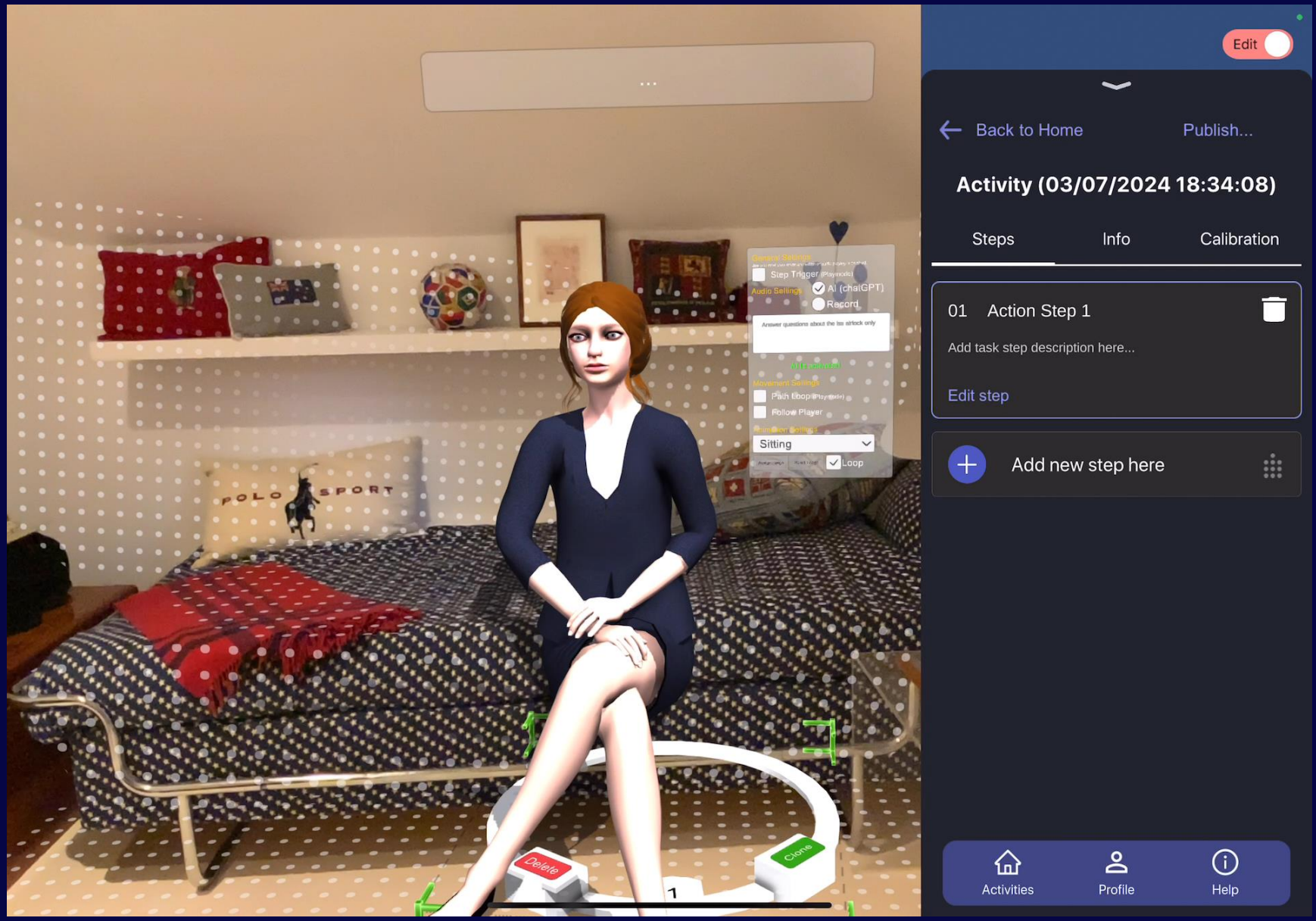
1. **Collaborative XR-enhanced authoring:**
   Development of procedure and training materials in a collaborative environment (Metaverse)

2. **XR-enhanced live instructor support:**
   Crew training with real time support by instructor

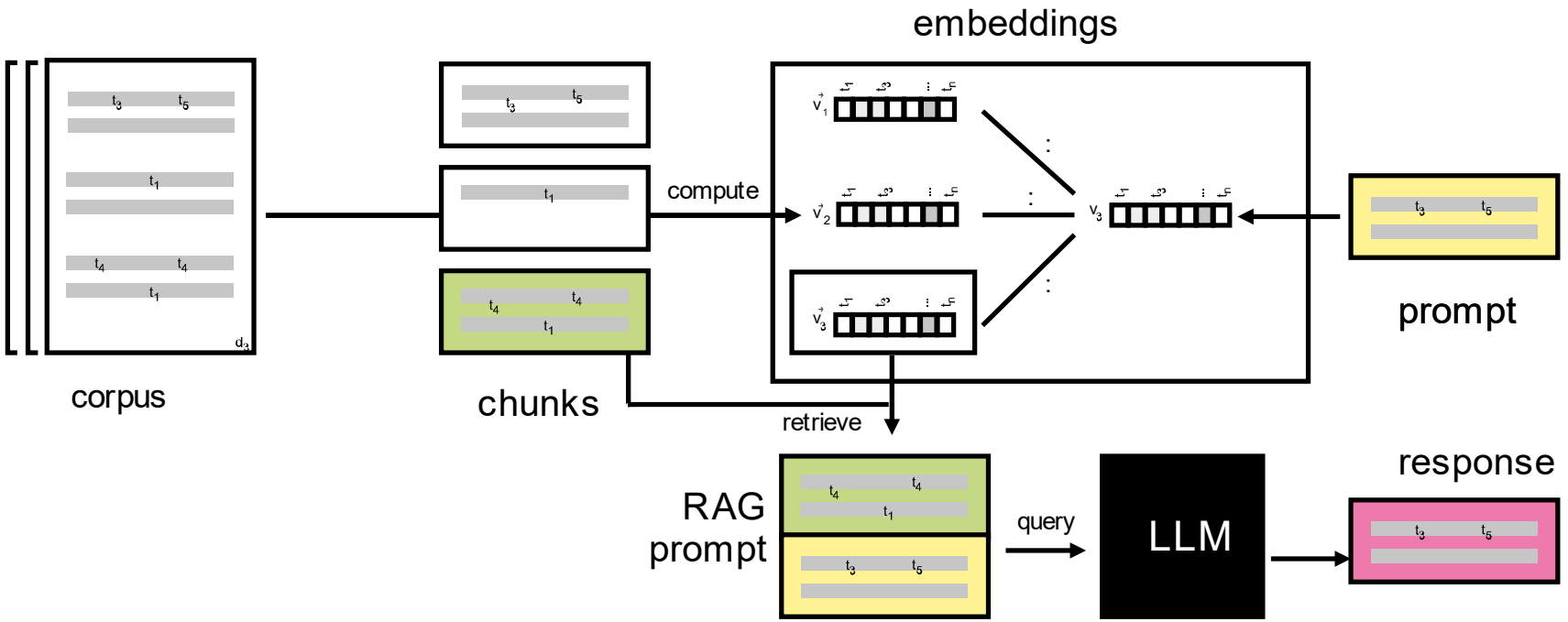
3. **Demi-synchronous, AI-enabled virtual instructor:**
   Crew training / operation with no real-time support

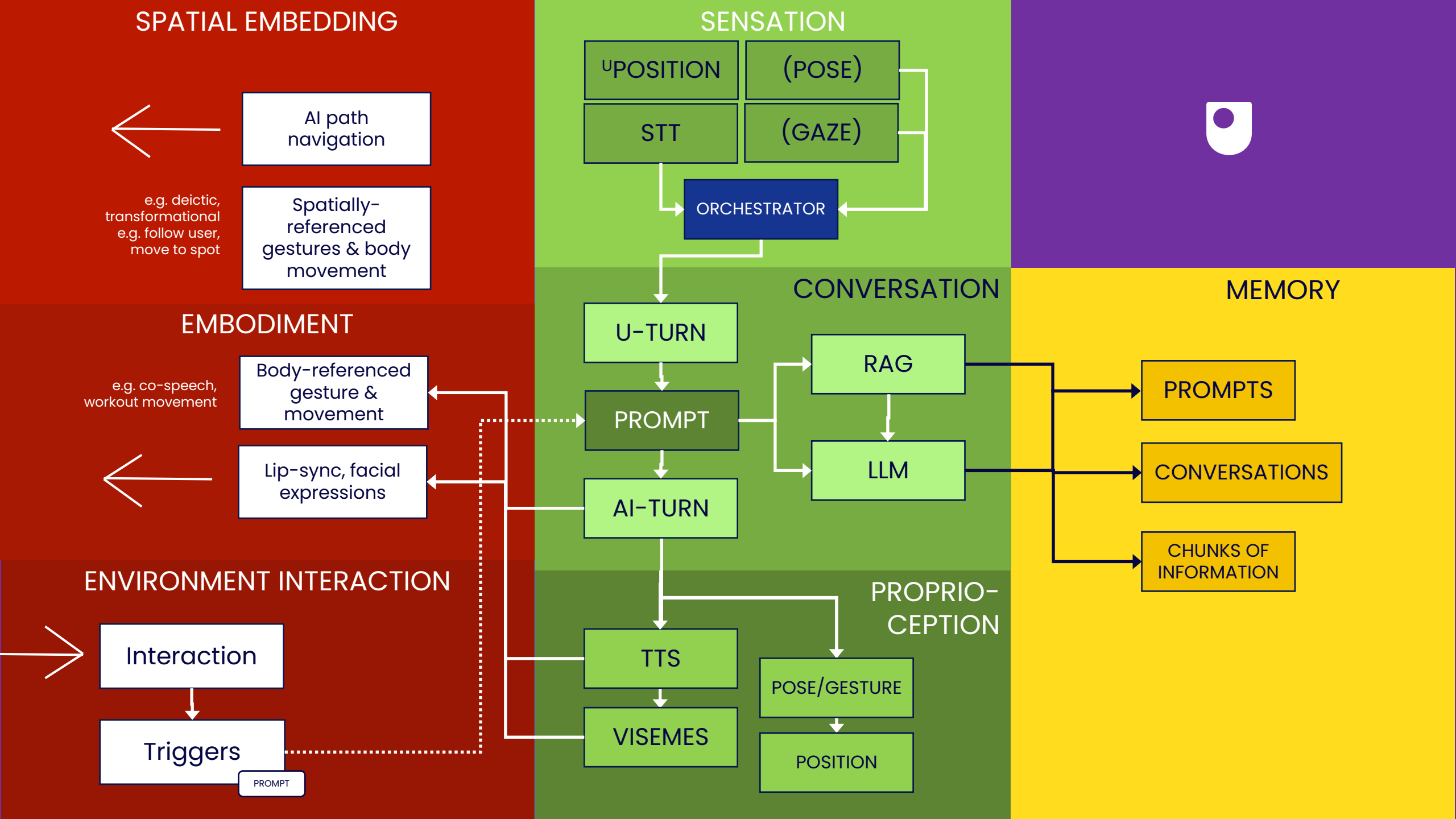


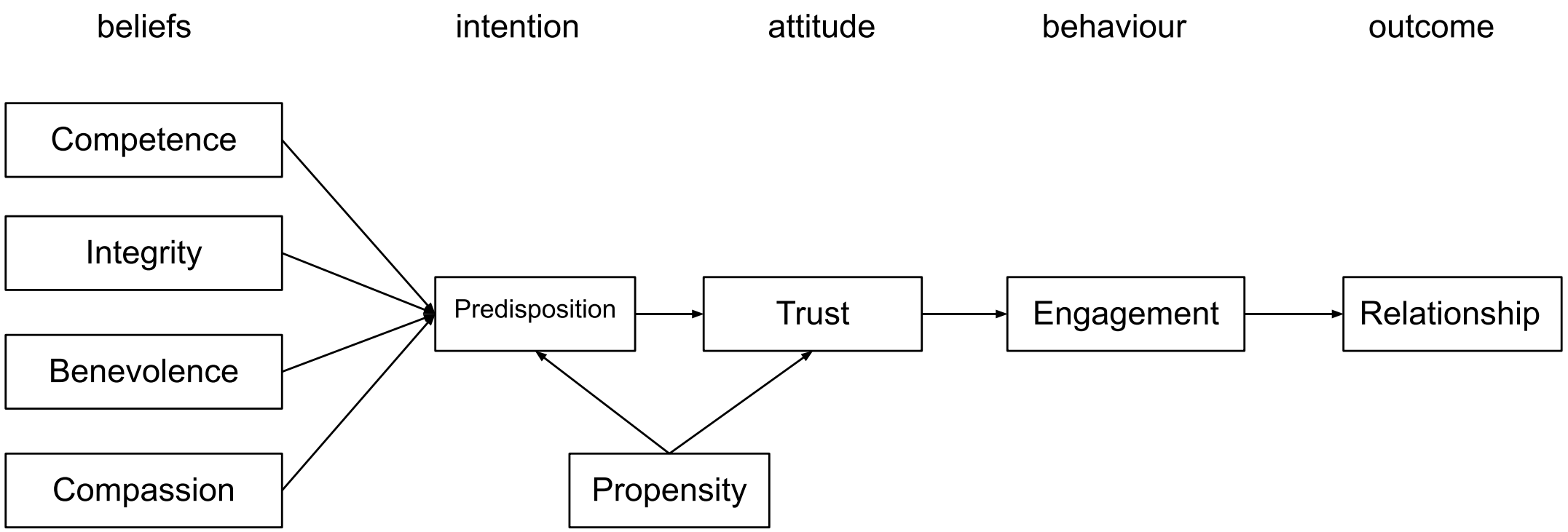
CARATE


Edit
Back to Home
Publish...
Activity (03/07/2024 18:34:08)
Steps
Info
Calibration
01 Action Step 1
Add task step description here...
Edit step
Add new step here
Activities
Profile
Help
Step Trigger
AI (chatGPT)
Record
Sitting
Loop
Follow Player
Delete
Clone

AI RAG ARCHITECTURE (Native RAG)




SPATIAL EMBEDDING
AI path navigation
e.g. deictic, transformational e.g. follow user, move to spot
Spatially-referenced gestures & body movement
SENSATION
UPOSITION
(POSE)
STT
(GAZE)
ORCHESTRATOR
EMBODIMENT
e.g. co-speech, workout movement
Body-referenced gesture & movement
Lip-sync, facial expressions
CONVERSATION
U-TURN
PROMPT
AI-TURN
RAG
LLM
MEMORY
PROMPTS
CONVERSATIONS
CHUNKS OF INFORMATION
ENVIRONMENT INTERACTION
Interaction
Triggers
PROMPT
PROPRIO-CEPTION
TTS
VISEMES
POSE/GESTURE
POSITION



Huang, 2023; Huang & Wild, 2023;
building on Mayer et al., 1995

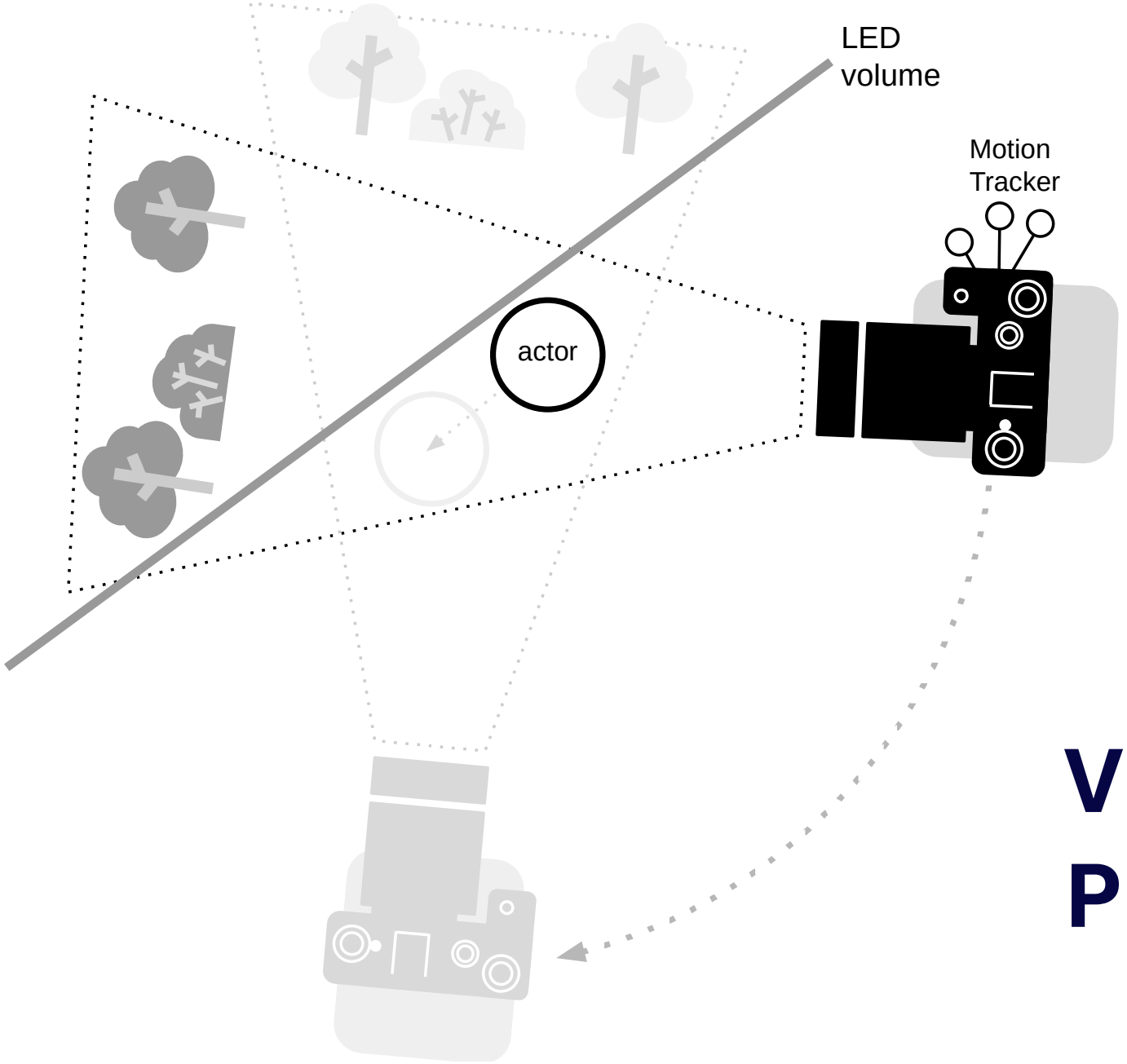
The Open University

"The Open XR Studios and reality-based learning are the next logical place for The Open University to take digital education. This is a very exciting and innovative venture for us and we hope it will lead to significant collaboration opportunities within the education sector and more widely with public and private sectors."

– Tim Blackman, Vice Chancellor

OpenXR studios

Opening 2025



The Open University

Virtual Production

YOOM

The Open University

World's first Volumetric Shakespeare: The Open University with Yoom, DeMontford, King's College, Cradle of English.

Ergonomics

Interaction

Space

Interaction

Locations

Conversational flow

SHIFT

KNOWHOW,
KNOW WHAT
AND
-> KNOW WHERE

Affect, empathy

Facial expressions

Body language

Gesticulation

Motor memory

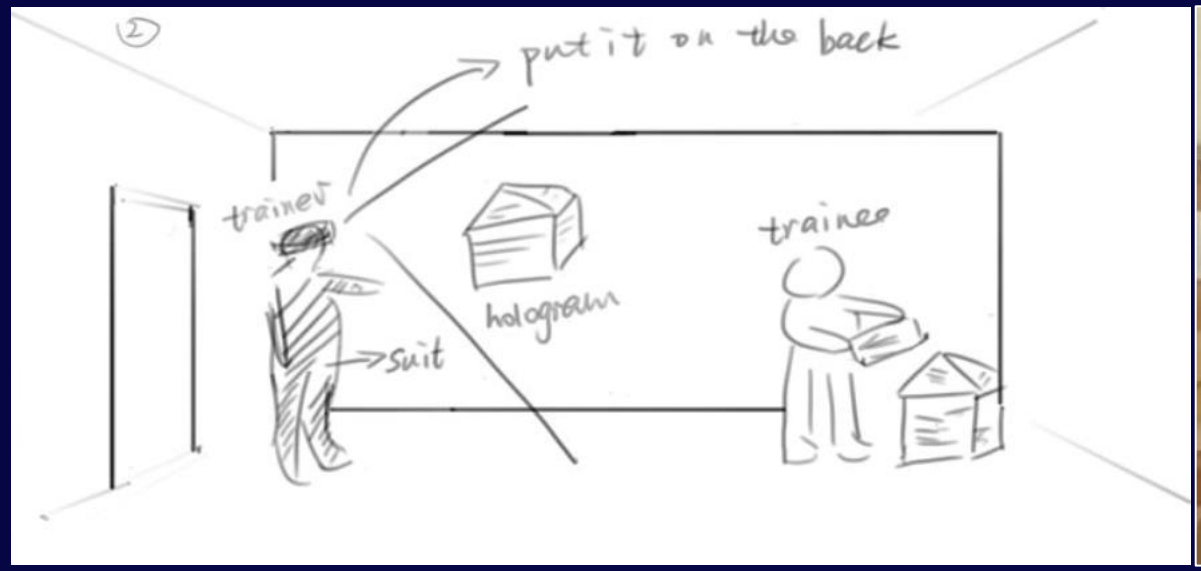
Proprioception

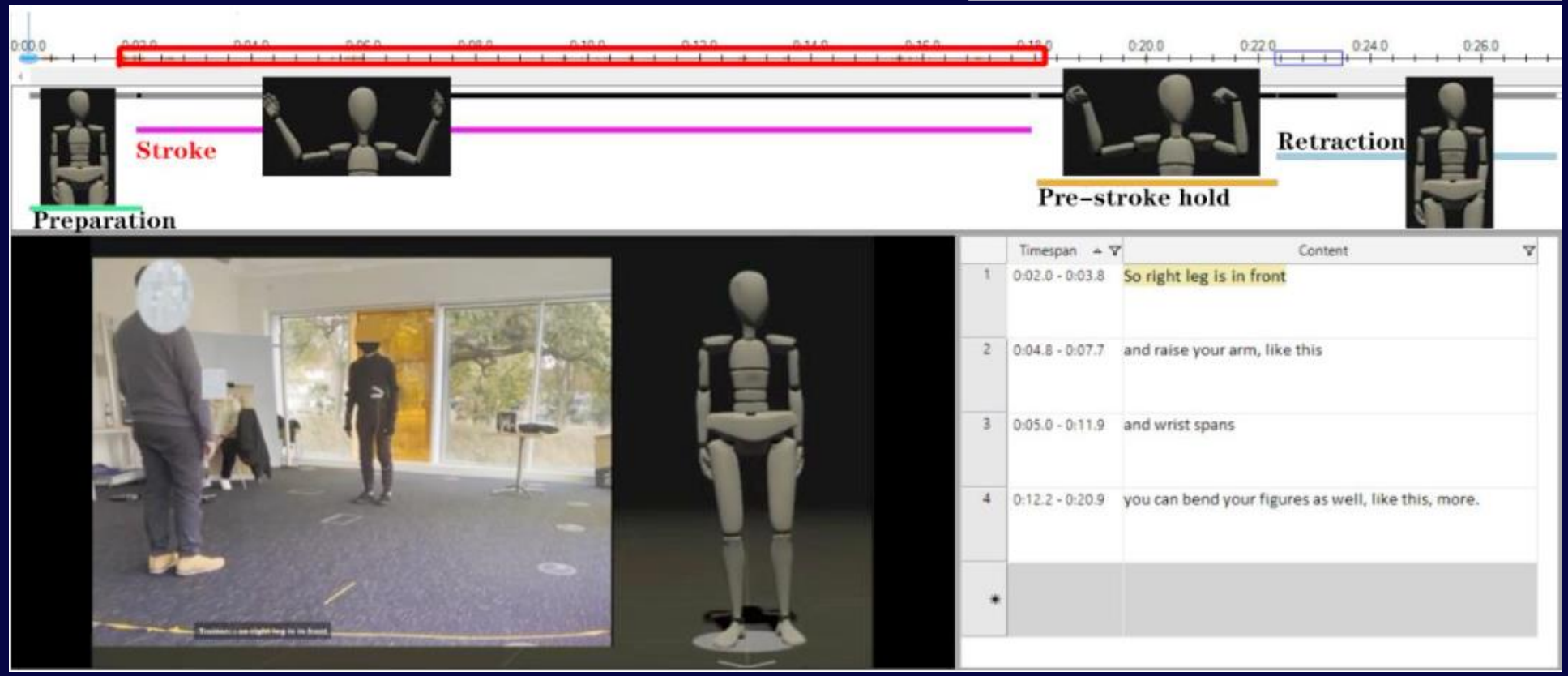
from EMBODIED to EMBEDDED cognition

Affordance Dimension							
	Metaconstructive Affordances Factors that can affect the attitudinal response to the technology or the task, changing the outcome.	**Checking progress** Visualising previous session data or learning objectives, recapping outcomes or learning progress.	**Activity mapping** Situating learning progress within a larger scope, such as structures that map competence, or professions.	**Self-monitoring** Adjusting levels of difficulty, following learning needs.	**Redesigning** Rearranging the tools or the interface to suit a learning style or specific objective.	**Reflecting** Enabling reflection on one's efficiency, learning progress or trajectory, mapping abilities to external standards.	**Reinventing** Creating new tools or augmentation types that better support one's learning style or objectives.
	Embodied Affordances Affordances affecting physical practice that can change the way the task is enacted.	**Indicating** Prompting the use of a method, tool or technique at a given location or time.	**Enacting** Demonstrate skill, method or tool use in situ, using glyphs or animations, trigger commands with hand actions.	**Shadowing** Showing relevant information as and when it is needed, live feedback on task performance, encouragement.	**Mimicking** Using tracking or wearables to record expert performance and show it to the learner, wearable data analysis.	**Tutoring** Evaluating practice based on either a gold standard or expert recording, identifying personal best performance.	**Choreographing** Building original learning practice based on past practice as well as flexible or adaptive learning goals.
	Propositional Affordances The potentiality arising from the use of informational elements that inform or educate the trainee.	**Displaying** Showing an augmentation, highlighting or drawing attention to a location or place of interest.	**Manipulating** Changing an object's appearance, such as its size or colour, or other property, such as its apparent weight or force.	**Organising** Following a set sequence or order, moving, adjusting or arranging objects in world space; pick and place.	**Reasoning** Deducing constants or variables from static or changing systems, isolating causes or effects.	**Classifying** Pattern recognition, natural language processing or classification of (inter)actions.	**Generating** Compiling event logs, generating summary reports of elemental data.
Learning Affordances for Performance Augmentation		**Remember** Retrieve relevant knowledge from long-term memory.	**Understand** Construct meaning from instructional messages, including oral, written and graphic communication.	**Apply** Carry out procedure in a given situation.	**Analyse** Break material into constituent parts and determine how the parts relate to one another and to an overall structure or purpose.	**Evaluate** Make judgements based on criteria and standards.	**Create** Put elements together to form a coherent whole; reorganise into a new pattern or structure.
		Process Dimension					

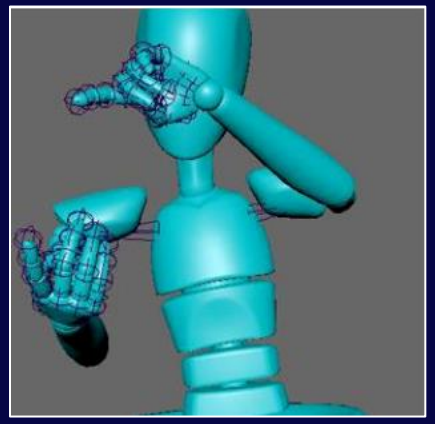
(Guest, 2024, p.132)

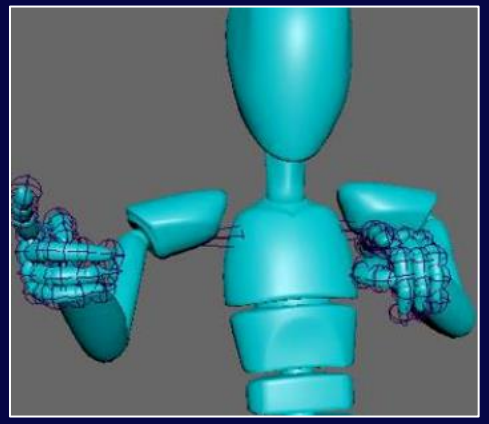
wild@open.ac.uk
@fwild@arvr.social
https://iet.open.ac.uk
https://pal.edtech.info

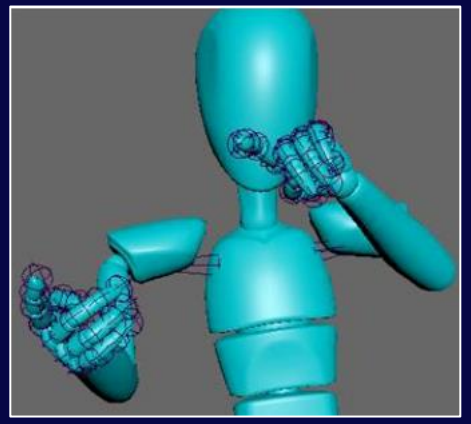




Huang, 2023; Huang & Wild, to appear







Huang, 2023;
Huang & Wild, to appear