

The HI Museum Case Study

Mission

Our mission is to transform museums into ***inclusive spaces of cultural exploration and learning*** by integrating Hybrid Intelligence technologies. We aim to enhance the acquisition, representation, and presentation of ***polyvocal knowledge*** through ***multimodal, interactive technologies***. By enabling diverse audiences to engage with and contribute to polyvocal content, we seek to make cultural heritage more ***accessible***, foster ***active participation***, inspire meaningful connections across ***different perspectives***, and promote greater understanding across ***cultures and generations***.

HI CARE principles and key research questions in the Museum case study

Collaborative

The system is designed to integrate expert input from curators, incorporate feedback from users, and continuously adapt based on these interactions.

- How can Hybrid Intelligence support meaningful collaboration between museum curators, AI systems, and users to co-create relevant and diverse museum content?
- What mechanisms can be implemented to gather and incorporate real-time user feedback, enhancing the guide's responses and enriches content over time?
- In what ways can a virtual museum guide foster empathy and cross-cultural understanding, and what methods can effectively measure these impacts?

Adaptive

The system tailors museum experiences to each user's expertise, interests, preferences, and cultural background through real-time processing and context-awareness.

- How can multimodal user data (e.g., eye gaze, voice, gestures, facial expressions) be used to detect user interest and preferences in real time, allowing the virtual guide to adapt its behavior responsively?
- How can adaptive algorithms personalize the virtual guide experience to meet the needs of diverse audiences while maintaining engagement and learning outcomes?
- What multimodal interaction techniques (e.g., voice, visual prompts) are most effective for adapting the guide's content and style to suit individual learning preferences?

Responsible

Responsible
The agent operates ethically by curating data carefully and presenting information with cultural sensitivity and fair representation.

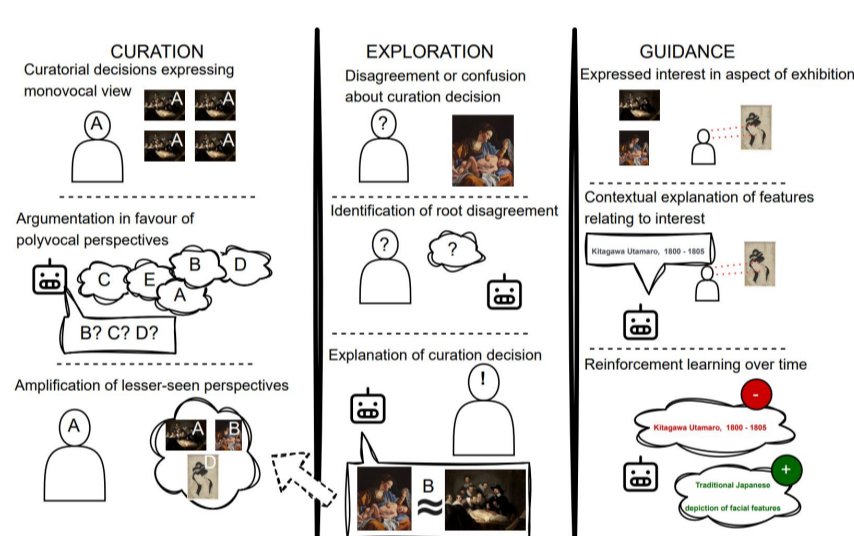
- How can data and knowledge be responsibly acquired and curated to ensure ethical representation of diverse cultural perspectives, minimizing bias in the AI system?
- What transparency protocols can be developed to help users understand the sources of information and the AI's reasoning process, fostering trust and accountability?
- How can bias-detection and mitigation techniques be implemented in the AI system to support fair representation of diverse perspectives in museum narratives?

Explainable

The system promotes transparency by helping users understand why certain narratives or artifacts are highlighted and enabling curators to refine its behavior.

- What methods can be used to make the virtual guide's decision-making process transparent and easily understandable to both visitors and museum curators?
- How can the guide provide clear, accessible explanations of polyvocal knowledge that allow users to understand and appreciate the diverse viewpoints presented?
- How can polyvocal knowledge be responsibly and transparently represented in a virtual museum guide to ensure diverse cultural perspectives are understood, respected, and accessible to all users?

2024 Demonstrator

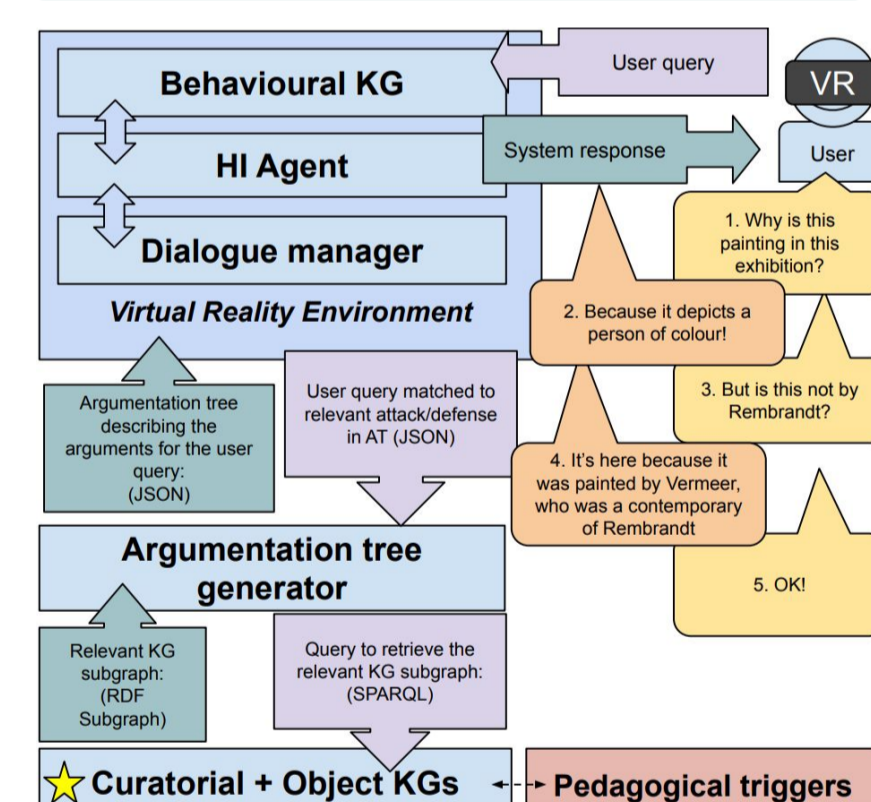


Demonstrator: Supporting the Critical Museum Visitor through Hybrid Intelligence (Scenario 2)

- **Goal:** Empower museum visitors to critically engage with object narratives through structured, contextually grounded dialogue in a virtual reality (VR) environment.
- **Method:**
 - Introduce **Pedagogical Triggers**—deliberate inconsistencies derived from conflicting facts within the **Curation Knowledge Graph**—designed to prompt critical reflection
 - Generate an **Argumentation Tree** that includes both supporting and opposing facts related to each trigger.
 - Feed this structured argumentation into a **LLM-powered dialogic system**, enabling dynamic and thought-provoking conversations.
- **Outcome:** Demonstrates how context-aware, argumentation-driven dialogue can enrich user experience and foster critical thinking in interactive cultural heritage applications.

Scenarios

1. **HI-Supported Curation** The HI agent collaborates with curators and community members by accessing and organizing explicit knowledge about artifacts to support informed, inclusive, and polyvocal curatorial narratives.
2. **HI-Supported Exploration** The HI agent engages visitors in dynamic, dialogic exploration by constructing responses through formal argumentation, grounded in explicit knowledge of objects, user behavior, and curatorial choices.
3. **HI-Supported Guidance** The HI agent employs reinforcement learning to adapt its responses in real time based on multimodal visitor cues—such as gaze direction, vocal tone, and follow-up questions—to personalize the experience.



Associated projects:

- 1.26 Knowledge Representation Formalisms for Hybrid Intelligence
- 1.34 Conversational access of large-scale knowledge graphs
- 2.7 Algorithmic Support for Online Deliberation
- 2.18 Knowledge acquisition methods for polyvocal knowledge graphs
- 3.10 Interactive Exploration of Bias in Cultural Heritage Collections
- 3.12 Subjectivity in AI
- 3.14 Explainable human affective and behavioral prediction
- 3.16 Large Language Models in Action: Designing Social Robots for Creative Group Collaboration
- 3.20 Persuasion and theory of mind
- 3.30 Learning Trade-offs in Multi-Stakeholders Multi-Objective Problems

Join us!

Monthly online meetings: Every 3rd Tuesday, 10:00–11:00

4 face-to-face meetings scheduled throughout the year

Annual report 2024

- **Consistent Engagement:** Monthly online meetings since May 2024, plus two in-person gatherings.
- **Strong Community:** A committed group actively driving the case study forward.
- **Shared Resources:** A living, growing list of assets available for collaboration within the case study.
- **Joint Demonstrator:** Developed and successfully presented at HHAI2025, combining Argumentation, Immersive Technology and Knowledge Graphs.
- **Outreach & Visibility:** Case study showcased at DH Benelux 2025.
- **Engineering Impact:** First engineering project progressing in collaboration with the Dialogue Cluster.
- **New Collaboration:** Partnered with SIG Reinforcement Learning to develop and apply a reinforcement learning framework for multimodal interaction in VR environments.

Annual plan 2025

- **Demonstrator Development:** Consolidate and extend the shared demonstrator, integrating it with the platforms developed through both engineering projects.
- **Experiment Integration:** Identify opportunities for other Museum Case Study participants to incorporate their experiments into the demonstrator, aiming to support 1–2 integrated experiments in 2025–2026.
- **Module Design Session:** Organize a dedicated session in late 2025 to identify and co-design new modules to be added after the core engineering phase concludes.
- **Cross-Cluster Alignment:** Strengthen alignment with the M&M Cluster and other engineering efforts to ensure coherence and shared progress.
- **External Collaboration:** Establish connections with external research groups working on related topics to explore synergies and initiate potential collaborations.
- **Community Engagement:**
 - Organize a Hybrid Intelligence for Museums Workshop at a conference (target: end of 2025 or 2026).
 - Host a seminar series featuring 1–2 invited speakers