

Supporting the Critical Museum Visitor Through Hybrid Intelligence

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Supporting the Critical Museum Visitor Through Hybrid Intelligence

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Motivation and scenario Museums play a critical role in shaping cultural understanding by presenting narratives that reflect historical, artistic and social contexts. With increasing recognition of decolonization, polyvocality and inclusivity in cultural discourse, museums must rethink traditional curation and visitor engagement strategies [2, 3, 4]. Hybrid Intelligence (HI) [1] can foster deeper engagement with diverse cultural narratives while enabling personalized curation and learning experiences.

Building on [5, 6, 7], we present a HI demonstrator that allows museum visitors to critically question and engage with curatorial narratives through structured, contextually grounded dialogues in a VR setting. The demonstrator features a virtual exhibition inspired by an actual museum display, authentically representing historically underrepresented communities. To stimulate critical engagement, the demonstrator incorporates deliberate “pedagogical triggers”—intentional narrative inconsistencies—that prompt visitors to question curatorial choices. For example, visitors might question how a 17th-century Dutch painting depicts black individuals respectfully during a period marked by Dutch participation in the slave trade. The agent provides contextually relevant explanations, for instance, highlighting the existence of a free black community in 17th-century Amsterdam authentically portrayed by Rembrandt.

Through structured, argumentation-based explanations, visitors can better understand curatorial decisions, bridging interpretative gaps and enhancing overall engagement. Our approach demonstrates how contextually-grounded dialogues improve user experience in interactive culture heritage applications.

Demo Framework Figure 1 shows the main components of the demonstrator.² The system uses three distinct **Knowledge Graphs**, each representing structured knowledge critical for the virtual exhibition experience. Firstly, the *Object Knowledge Graph* describes the cultural heritage objects and their associated metadata, such as object title, creator(s), hi-resolution images and dimensions essential for VR rendering.

¹M.G., T.T.L.H. and D.J.V. have equally contributed to this paper.

²Documentation of the current version of the demonstrator can be found at https://github.com/hybrid-intelligence/HI_MuseumDemo.

Secondly, the *Curation Knowledge Graph* describes curatorial decisions, including narratives shaping the exhibition and the significance of each object within these narratives. It is derived from exhibit documentation and partially represented using the Linked Art application profile for CIDOC-CRM.³ Within this knowledge graph, we intentionally introduce “artificial” inconsistencies—known as pedagogical triggers—to provoke visitors into reflective and critical discussions. These triggers are represented as “attack” relations in the KGs, prompting the construction of an Argumentation Tree comprising both attacking and supporting statements. Finally, the *Behavioral Knowledge Graph* records visitor behaviors within the virtual environment, capturing data such as virtual location, eye gaze, and personal preferences.

An Argumentation Tree, constructed from subgraphs extracted from these three KGs, supports dialogue generation. Specifically, it integrates relevant object metadata, curatorial context (including pedagogical triggers), and visitor-specific information. Utilizing the method described in [5], the system generates the **Argumentation Tree** by addressing these introduced inconsistencies through structured argumentation.

This Argumentation Tree, along with relevant object metadata, is processed by the **Dialogue Generation and VR Integration** component. A prompt-construction module translates the Argumentation Tree into a natural language prompt for a large language model (in our case OpenAI’s GPT-4o mini). The language model outputs dialog elements (utterances), which the RASA⁴-based AI agent uses to facilitate user interactions within the Unity-developed VR environment.

Future extension Future extensions include broadening the types of recognized user utterances and enhancing real-time processing capabilities. Specifically, we aim to process user queries immediately as “attack” relations to the KGs, dynamically generating argumentation trees in real-time. This extension could capture valuable user inputs, enabling niche-sourcing and enriching curatorial and content knowledge through visitor contributions.

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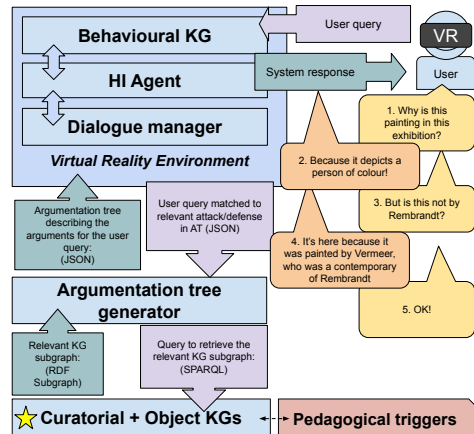


Figure 1: The proposed system architecture. On the right, an example dialogue generated from a disagreement about curation.

³<https://linked.art/>

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