

From Representational Events to Cognitive Ecologies: Designing Meaningful Interactions in AI-Driven Cultural Interfaces

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Abstract: This article explores the concept of representational events as performative and cognitive acts at the heart of interactive digital environments such as serious games, digital narratives, and immersive cultural simulations. Rather than viewing representation as static reflection, we propose it as an event, a temporally situated moment of meaning-making where users construct possible worlds through the interpretation of symbols. Drawing on ergodic literature, ludology, and phenomenology, we argue that users engage in situated co-authorship, navigating through branching narratives and ludic structures that foster reflection, immersion, and identity construction. The representational event becomes a critical site for activating both cognitive and emotional faculties. Examples from role-playing games, VR museums, and AI-driven cultural platforms illustrate how these events empower users to explore, reshape, and reinhabit cultural narratives. Referencing theorists like Huizinga and Gadamer, we trace the ritual and symbolic dimensions of these environments. We propose a framework for user experience design in cultural heritage systems that redefines representation as an act of embodied cognition and cultural engagement. This re-framing positions learners not as passive recipients, but as active meaning-makers and co-creators within digital heritage ecosystems.

Keywords: Cultural Heritage, Representational Event, Serious Games, Embodied Cognition.



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1. Introduction

In the rapidly evolving landscape of digital culture, interactive systems such as serious games, AI-driven storytelling platforms, and virtual heritage environments are reshaping the ways we access, interpret, and construct cultural meaning. At the core of these systems lies a fundamental cognitive process: the representational event. Rather than treating representation as a passive reflection of reality, this article argues that representation should be understood as a situated, performative, and participatory event, in which users co-construct symbolic meaning through interaction. Drawing from ergodic theory (Aarseth, 1997), game studies, cognitive phenomenology, and educational design, this article proposes a theoretical and design

framework for representational events as central to a post-digital pedagogy and cultural user experience.

2. Defining Representational Events

A representational event is a moment of embodied cognition in which a user attributes meaning to a symbol, image, or narrative configuration within a digital system. Unlike conventional understandings of representation as static or fixed, representational events are dynamic, recursive, and context sensitive. The user constructs a possible world not merely by interpreting a symbol but by engaging in a complex interplay of decisions, emotions, and expectations that actualize meaning over time.

This cognitive act is inherently ergodic, demanding effort, navigation, and interpretation (Aarseth, 1997). The user's role is not to receive a message but to become a co-author of the experience. For example, in a cultural heritage game where players explore a reconstructed ancient site, each action, interpreting a glyph, choosing a dialogue path, solving a riddle, becomes a node in a network of representational events. These micro-decisions accumulate to form a coherent narrative experience, while allowing space for ambiguity, multiplicity, and reinterpretation.

3. Philosophical Groundings: Play, Ritual, and Representation

The theoretical lineage of the representational event can be traced through Huizinga's concept of the "magic circle" (1938/1998), in which play suspends ordinary reality to create a temporary, meaningful world with its own rules and affordances. Similarly, Gadamer's philosophy of play in *Truth and Method* (1960) posits that play is not controlled by the subject but reveals itself in the act, an ontological structure of being that allows for the free emergence of meaning. When applied to digital interaction, these ideas suggest that representation is not an object but an eventuality, it happens in time, through engagement. In cultural contexts, this play becomes ritualistic. Drawing on Codrington's concept of Mana (1891), we can see how users invest symbolic elements with a kind of spiritual or communal force. In heritage games or digital rituals (such as VR reconstructions of mythic stories), symbolic meaning is enacted collectively, forming communities of interpretation.

4. Cognitive and Emotional Dimensions

Representational events activate cognitive-emotional circuits that are central to meaningful learning. Cassese and Granato (2011) show that ludic experiences meet fundamental psychological needs: the desire to explore, express, dismantle, and reconstruct. When users make choices in a branching narrative, such as deciding the ethical fate of a character based on historical facts, they simultaneously engage their critical thinking, ethical reasoning, and affective empathy. These decisions are more than gameplay; they are mirrors of self-reflection, echoing Ariemma's (2023) insights on digital selfhood: through choices, the user transforms, revisits, and reinterprets themselves. Such experiences align with constructivist pedagogy, where learning is seen as active meaning-making. However, representational events go further: they turn the learning process into a simulation of cognition itself. As users revisit their decisions, explore counterfactuals, and reflect on outcomes, they engage in what we might call iterative identity play, a powerful tool for both education and transformation.

5. From Interaction to Interpretation: The Role of AI

The affordances of AI and adaptive systems dramatically expand the depth and responsiveness of representational events. With semantic retrieval, natural language understanding, and procedural content generation, digital systems can now co-evolve with users' cognitive trajectories. For instance, an AI-powered museum guide can tailor its narrative to the user's background knowledge, adjusting complexity and thematic focus, thus amplifying personal engagement. This adaptive capacity is particularly important in cultural heritage, where interpretive pluralism is essential. AI allows systems to mediate between conflicting narratives, foreground marginalized voices, and create spaces of negotiation. In this way, representational events become microcosms of democratic discourse, where cultural meaning is constructed through dialogue between user and system, past and present, self and other.

6. Case Studies and Applications

To illustrate the theory, the paper presents several application domains:

- **Virtual Archaeology Games:** Users explore ancient sites reconstructed in 3D, making decisions that influence the unfolding narrative (e.g., deciphering inscriptions to unlock mythic sequences).
- **Museum-Based Interactive Stories:** AI guides personalize the visitor journey by learning from user behavior, dynamically adapting the story being told.
- **Live-Action Role Play (LARP) for Heritage:** Participants physically embody historical roles within immersive settings, co-constructing a shared symbolic space that echoes ritual performance.

In each of these examples, representational events are not only educational tools but acts of cultural participation, enabling users to take part in the living memory of a community or place.

7. Design Principles for Representational Events

To effectively design systems that foster rich representational events, we propose the following principles:

- **Narrative Openness:** Encourage branching paths, ambiguity, and multiple endings to support interpretive agency.
- **Symbolic Density:** Embed cultural symbols that require cognitive engagement and reinterpretation.
- **Embodied Interaction:** Design for sensory involvement, touch, voice, gesture, to ground cognition.

- **AI Responsiveness:** Use adaptive systems to personalize and deepen user experiences.
- **Ritual Framing:** Situate interaction within meaningful symbolic structures, using metaphor and myth to create resonance, deepen immersion, and evoke collective emotional and narrative significance.

Having established the design and technical underpinnings, we now turn to the pedagogical consequences of the representational event framework.

8. Implications for Pedagogy and Media Education

The implications for education are profound. By treating representation as event rather than object, digital pedagogy shifts from transmission to transformation. Learners are not passive recipients but symbolic agents, whose interpretive labor is central to learning. Representational events offer an avenue for teaching critical media literacy, cultural empathy, and symbolic fluency, skills essential for navigating the complexities of a digitized and pluralistic world. Moreover, these systems support inclusivity by allowing learners to approach content from diverse perspectives, empowering underrepresented voices, and validating alternative ways of knowing. The operationalization of the representational event model carries profound implications for cultural design and post-digital pedagogy. For designers and institutions, this framework demands a strategic shift toward game thinking and rigorous educational design principles, moving beyond passive content delivery. Its practical application centers on fostering Narrative Openness and Symbolic Density, which encourage interpretive agency and deep cognitive engagement with cultural symbols and branching narratives. Such engagement cultivates game literacy - the critical ability to interpret and interact meaningfully within structured digital systems.

Adaptive AI systems and immersive interfaces are essential to actualizing these events, serving as catalysts for reflective and inclusive learning. Intelligent museum assistants, often based on Retrieval-Augmented Generation (RAG), can dynamically personalize narratives by adjusting complexity and thematic focus according to users' backgrounds and contexts. This adaptability promotes inclusivity, empowering learners to engage with cultural content from multiple perspectives and mediating between diverse or conflicting narratives.

By involving users in consequential decision-making and counterfactual exploration within immersive environments such as virtual archaeological sites, these systems foster new critical literacies, metacognitive development, and ethical reasoning, provided that design practices remain transparent and culturally sensitive in the reuse of heritage assets. Ultimately, educators act as facilitators, guiding learners through inquiry-based, transformative experiences where interpretive labor becomes central to knowledge co-creation. This paradigm supports cultural empathy and symbolic fluency, equipping learners to navigate the complexities of a digitized and pluralistic world.

The concept of the representational event, framed as a situated, performative act of symbolic meaning-making, demands a comprehensive overhaul of design and pedagogical practice within cultural institutions. This approach mandates a shift towards game thinking, prioritizing rigorous educational design to move beyond the

passive consumption of cultural data. Practically, the framework leverages Narrative Openness and Symbolic Density to compel the user, now defined as a co-author, toward genuine interpretive agency. This engagement cultivates game literacy-the critical capacity necessary to interact meaningfully with complex, structured digital environments.

Achieving this level of meaningful, context-aware interaction is fundamentally reliant on advanced Adaptive AI systems and immersive interfaces. Intelligent museum assistants are typically implemented using modular architecture that integrates Large Language Models (LLMs) with Retrieval-Augmented Generation (RAG). The RAG component is crucial because it addresses critical limitations of generic LLMs, such as the risk of hallucinations and the lack of domain-specific knowledge. By grounding the LLM in a curated knowledge base of historical and archaeological data, the system ensures that personalized responses, dynamically adjusting complexity and thematic focus based on user input, maintain philological accuracy and scientific rigor. This technical rigor, which often involves structuring data through ontologies (e.g., CIDOC CRM) and knowledge graphs, is essential for the framework's credibility in heritage education.

Immersive interfaces built using game engines such as Unity or Unreal Engine provide the necessary environments for embodied interaction, allowing users to engage in consequential decision-making within simulated spaces, such as virtual archaeological sites (see Barbagallo, Rizza, et al.). The exploration of counterfactuals within these environments facilitates metacognitive development and ethical reasoning. This process encourages learners to reflect profoundly on their choices, mirroring the concept of iterative identity play.

A critical operational requirement is the ethical and transparent reuse of heritage assets. Digital heritage assets, particularly 3D reconstructions created by archaeologists, like those from Haghia Triada, Borg in-Nadur, or Polizzello, are indispensable (see Barbagallo, Stanco et al.). These models serve a dual role: not only are they tools for visualization and heuristic analysis, but they also function as high-quality, domain-specific training data for generative AI systems. This archaeologist-led modeling ensures that AI-generated content aligns with archaeological context, mitigating hallucination risks and preserving the intellectual integrity of the original research. Transparency, scholarly attribution, and cultural sensitivity in the management of metadata are non-negotiable requirements for sustainable digital practice.

Ultimately, this paradigm shifts pedagogy from transmission to transformation. Educators assume the role of facilitators, guiding learners through inquiry-based experiences that encourage collaboration and critical exploration. This active interpretive labor becomes central to knowledge co-creation, fostering cultural empathy, symbolic fluency, and the new critical literacies required to navigate a digitized and pluralistic world. The interdisciplinary expertise of the Digital Humanist is key to bridging the computational requirements of AI architectures with the necessary philological rigor and cultural sensitivity needed for authentic engagement.

9. Conclusions

In conclusion, the representational event is a powerful lens for understanding and designing interactions at the intersection of narrative, cognition, and culture. It reframes the act of representation as a temporal, performative, and participatory event, shaped by the user's agency, context, and symbolic imagination. As AI, im-

mersive media, and interactive storytelling continue to redefine our relationship with knowledge, embracing this model can lead to more inclusive, meaningful, and reflective cultural systems. Designing for representative events means designing for meaning, not just function. It requires a rethinking of interfaces such as epistemic ecologies, spaces where bodies, symbols, algorithms, and memories merge to shape the contours of understanding. In this shift, education, culture, and technology converge not as separate domains, but as co-actors in becoming.

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