Heritage Role Playing-
History as an Interactive Digital Game

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ABSTRACT

Creating virtual heritage environments that intend to be both engaging and educational is a challenging process. Digital archaeological reconstruction has been concerned with exact replication of facts rather than with understanding, for the latter raises the annoying dilemma of how to present scientific uncertainty. A computer model almost invariably implies certitude, and archaeologists are still not sure how to convey the murky battle of historical interpretation.

Yet games are quite happy to allow users to 'muddy' historical settings. And while the bulk of computer game design may be justly considered a-cultural or even anti-cultural, the underlying techniques of engaging interactively with the audience offer new ways of increasing the popularity and immersive learning of virtual environments.

However there are some serious issues in heritage projects adopting a game-style approach. Would using interactive game techniques and technologies create a more engaging user experience? If we can animate the past in this way, will the entertainment factor help or impede learning, and how will we know how effective the interactivity is? And would our results help bridge the gap between the industry (be it virtual exhibitions or interactive game design) and academia?

Categories and Subject Descriptors

J2. [**Physical Sciences And Engineering**]: Archaeology.

General Terms

Performance, Design, Experimentation, Human Factors, Theory.

Keywords

Virtual environments, culture, interaction, evaluation.

1. INTRODUCTION

In 1997 Jane Murray published 'Hamlet on the holodeck: the future of narrative in cyberspace', which forecast the computer as a future platform for interactive drama [15]. Yet a great deal of recent literature has focused on the failure rather than success of virtual environments (particularly three-dimensional ones) as an engaging medium of entertainment and education [5, 7, 14, 18].

In this article we will discuss three key problems in designing virtual environments that in some way depict the values of past cultures. The first problem is how to create a feeling of immersion or of presence in a virtual environment –how we make the past come alive for people so that they feel they are transported 'there'. This has often been seen as a technical limitation in the presenting of what appears to be reality.

Secondly, our idea of what reality is may be at odds with understanding the past or a distant place from a local perspective. What does reality mean when we are trying to recreate and understand cultural perspectives? If it is interactive how do we interact with the cultural material in a meaningful way?

If we do manage to create an engaging and believable virtual environment, will the novelty or entertainment value actually impede the knowledge gained by the users? In virtual heritage environments this is particularly evident in the relation of individual freedom to explore and interact with the need to convey historical information. We may for example create an entertaining game but will that allow us to convey varying levels of historical accuracy in reconstructing the past?

2. Types of Virtual Worlds

Some virtual heritage environments are assessed in terms of ergonomics (how effectively 'usable' these environments are) or subjective involvement and engagement (also known as presence or telepresence- 'the sense of being there'). This field is still in its infancy-there is still confusion and debate as to the meanings of 'immersion' and 'presence' and hence research has tended to be task rather than context-driven [14, 18, 20, 21]. The majority of presence research has not concentrated on how engaged and involved users are, but whether they are sufficiently deluded into thinking they are in a real place.

Virtual heritage environments, for example, are typically archaeological reconstructions of past cultural settlements designed to help our visualisation of past objects rather than 'embed' us in past cultural values.

However, recent research indicates that being able to fill in the blanks, to imaginatively reconstruct, is more important than photo-realism when experiencing virtual environments. Only recently have researchers found that realistic environments can bore people if they do not have interactivity, tasks, and some idea of other people (also known as agency); all features of popular computer games [7, 14, 18].

Perhaps part of the problem is that designers have not fully explored how people can interact with virtual environments in engaging and educational ways. The fact that digital technology is fast improving may have blinded us as to why we want or need it.

One way of attempting to answer user needs, is to understand the main types of virtual environments and what they have been designed to provide for.

2.1 Inert 'Explorative' Environments

The first type of virtual environment is the visual (sometimes with sound). One can walk around, zoom in and out of objects (say buildings), and that is about it. Orientation and view is manipulable, but the environment is not really interactive, as it does not affect user actions, and is not modifiable. For example, a three-dimensional fly-through of a building. The advantage and disadvantage is that the environment is really a finished product; it is not affected by inhabitants, and so manages to be definitive, immutable, and appear consistent in appearance, good for blueprints.

Only history is not a blueprint but a mass of interpretations, actions, intentions and beliefs. Yet even virtual heritage environments lack change, or interaction, or the ability to store interaction history. For example, many virtual heritage sites have brilliantly detailed temples, but no people, and no goals for visitors to solve. Users may be able to change part of the environment but seldom does the environment 'remember' users, their paths, actions or discoveries.

2.2 Activity-based environments

The philosopher Martin Heidegger, would say an activity-based environment does not 'world'. For it does not allow users to change their approach to things through doing. Even flight simulator games are more advanced, for they are processional, through using them one can actually learn to fly a place. So the second type of environment is activity-based.

However acknowledgement respect and social status is not available in a cockpit, nor can users engrave a signature in the leather seat. If they exit and re-enter the program it is not likely to remember them.

2.3 Cultural or 'Hermeneutic' Environments

For Doreen Massey, place may have any of the following features: a record of social processes; fluid boundaries; and internal conflicts [13]. A place is not a concrete fixed concept, and does not need to be a set of unique elements. Often places are full of mementos from other places. So a place is more like a nexus, or a web of associations, cultural affordances and memories. The question then is how do we gain such a sense of place via virtual environments?

We can argue that in order to create a virtual heritage environment with a notion of a 'place' (a region recognisable to a user as a culturally coded setting), that we need to have more than merely identifiable or activity-based virtual environments. A place can also carry cultural indications of inhabitation driven by a similar or different cultural perspective to that of our own. A virtual heritage environment must allow us to see through the eyes of the original inhabitants, or at least feel that this place once belonged to someone else [5].

The latter feature one might call an external cultural presence. If we still feel that the cultural presence is from long ago, it is passive. If we feel that the cultural presence is still around us, then it is active. In order to have an internalised cultural presence, we must feel that we are becoming part of a culture, that what we believe can be transmitted, recognised and socially acknowledgeable by others.

Hermeneutics argues that we must grasp the world of the interpreter as well as the world of the interpreted in order to gain the meaning of the text or object of art. For example, the philosopher Hans-Georg Gadamer wrote that language is inter-subjective, exemplified by how children learn. They learn by seeing how others respond to them: learning is a totally interactive process, and it is language itself that constitutes our life-world.

To quote Gadamer's translator David Linge [9]:

"..the hermeneutical has to do with bridging the gap between the familiar world in which we stand and the strange meaning that resists assimilation into the horizons of our world."

Where our environment refers to a long extinct civilisation, such a bridging is perhaps impossible, unless we somehow can bring the ghosts of the culture back to life. In other words, a feeling of strong cultural presence requires social presence, the presence of others that we are socially bound to.

If theoretically this 'hermeneutic' dimension could enhance virtual environments, the question arises as to how we can achieve this in practice. And this answer may surprise you; we can achieve this by studying computer games.

3. Pros and Cons of Computer Games

The technological limitations of internet-available virtual environments do not seem to have hindered the popularity of complex games. The most popular form of virtual environments is arguably the computer game. Nearly 75 per cent of people under thirty have played a computer game; it outsells books in the US and is worth more than 80 per cent more than videos in the UK. Entertainment software is the fastest growing of all types of entertainment, outselling films. Current game consoles also rival supercomputers of a decade or more and are used for AI research, [1, 3, 11, 12].

Games have context (user-based tasks), navigation reminders, inventories, records of interaction history (i.e. damage to surroundings) and social agency. Engaging virtual environments requires interaction geared towards a task, a goal, [18, 19]. As in games, virtual environment users may prefer personalization. Further, as the most popular games (excluding Tetris), requires representations of opponents (social agents), so too do virtual environments.

Games are a familiar medium to users, and when in game mode, abstraction can be just as engaging to users as a sense of realism. Games train us how to learn and how to use props as cultural tools, [10]. Further, as users become in engaged in the tasks, it is easier to observe them without damaging their level of engagement, especially as games traditionally have built-in evaluation mechanisms. Furthermore, games cater to learning curves of new users by advancing in complexity over time, and can be personalised [1].

Therefore, we can argue that there are certain techniques that virtual environments can learn from game design, but which ones are the most effective? In our view, virtual environments recreating past cultures needs such interactive features and more in order to be engaging. Yet despite the rich detailing of environments, agents, and artifacts, three-dimensional adventure games do not have a rich sense of cultural immersion.

Instead adventure games are tainted by the 'Indiana Jones' quandary. Archaeology is glorified via popular culture, but not for preservation, only for exploration of novelty and the demonisation and destruction of other cultural perspectives.

For computer games too often destroy rather than create cultural context. In other words, games do not change ways of thinking in relation to a culturally appropriate setting or 'place' [4].

3.1 A Case Study: Heretic II

Let us examine the computer adventure game Heretic 2, as it is analogous in form to virtual heritage environments, only it has added tasks, goals, and interactive features. In the game, the returning hero finds his town deserted except for the diseased and crazed survivors. His goal is to find the source of the virus and hence its cure.

Unfortunately, battling to escape the town he himself is infected. Time is now running out, and every so often he too faints (often at the worst possible moment). He must explore various palaces and towns belonging to different races, identify doors levers and portals in order to go further, gain more powerful weapons and other artifacts, find power-ups to boost health, and combat ability, and survive being attacked by various creatures with various weapons and abilities (Figure 1). The terrain can be outdoors or urban, and he must avoid bursts of flames, outdoor spaces (vultures will swoop on him), remaining in one place too long (creatures will start tracking him), swamp, lava, and staying underwater too long.

Figure 1: A Screenshot of Heretic II.

In Clive Fencott's terms [8], Heretic 2 uses attractors (phototropia and glints of light, prospect of open spaces), repellers (aliens guard power ups and narrow passageways), there are connectors (such as ropes and water portals and crates you can use as steps). The sureties are the creatures that attack, power ups, water, land, lava. Constraints include the faints, every so often users have to follow certain paths, and start only with two weapons. Affordances are the ropes, weapons, power-ups, levers tools buttons ledges rubble (closed doors) and sliding doors.

In our terms Heretic 2 has dynamically attenuating physiological zones that record interaction history (via corpses and damaged externs his passage), avatar dialogue (though not in the single player role interactive), artifact-related tasks to help direct him to

the main goal, and a mostly static two-dimensional map (though it indicates your position on the map).

Virtual heritage may well need the above interactive features and more in order to be engaging. Despite the rich detailing of environments, agents, and artifacts, Heretic 2 does not have a rich sense of cultural immersion for the same reasons as other mainstream computer games. The only goal is for collecting artifacts for the vanquishing of others, social interaction is limited to violence, time spent on reflection is punished, and we do not develop any feeling for the perspectives of the local inhabitants as their actions are purely for fight or flight.

3.2 Games Lack Cultural Presence

What is 'Culture'? Is it a product, something you can point to, or a process, something that relates things you can point to? Whatever culture is, it surely is more than a library of objects.

"In the postmodern world where things have systematically become monuments, nature has been transformed into 'reserve', and knowledge is giving way to information and data, it is only a matter of time before Other people and their cultures become 'models', so many zeros and ones in cyberspace, exotic examples for scholars, voyeurs and other interested parties to load on their machines and look at. Cyberspace is a giant step forward towards museumization of the world: for anything remotely different from Western culture will exist only in digital form." [16].

Some have argued that culture is a learning and recording process. Researchers believe we learn about a culture through dynamically participating in the interactions between three major elements. Cultural setting is a place that indicates certain types of social behaviour; artefacts and how they are used; and people teaching you a social background and how to behave through dialogue devices such as stories and commands; (along with or counter to your own personal motive).

We could reorder the above, by suggesting cultural learning is derived from interactions between places, objects, and people. So in our definition, the cultural is a subset and recorder or clue as to how to act socially. To act as part of a social group, we do not need to use objects (apart from language) but to act culturally means we must encode objects with meaning, [17].

3.3 The Non-informative Role of Panic

A time-based task (a typical component of games) means that people would be punished for contemplating their surrounds. So we need to reduce or replace the time constraint, by making time based goals only part of the experience, or the timing could be triggered by significant events. We could further allow the option of replays so that people can reflect on what they had done. However, there could be a problem with the pace and suspense, if there are periods of time-based constraints and then periods without time-based constraints.

3.4 Interaction Affects Authenticity

We can avoid artefacts solely designed for conflict and destruction when we design virtual environments with cultural presence. But yet another factor that might conflict with interaction, and records of interaction history, is that (virtual) tourists traditionally look for authenticity. Paradoxically this means a desire for an environment that is both authentic (untouched by crowds of tourists and tourist related industry), and

amenable to tourism (replete with contemporary tourist resources and facilities).

Perhaps most importantly, if the virtual environment shows changes over time (something multimedia is brilliant for), historical accuracy needs to be aimed for, for educational reasons, but people also want autonomy! Virtual tourists want an opportunity to interact with history and to chose interpretations of the past, but as we advance in time towards the present the more factual the account of what happened, the less the opportunity for autonomy. There are many possible partial or complete solutions to this issue; we wish to suggest nine of them.

3.4.1 Ancillary Non-Celebrity characters
We could create ancillary characters that are not recorded in history, and allow people to take on their roles. Given the ability to 'augment' history with their own personal interaction history (fictions), perhaps the interactions they have with historical figures (henceforth referred to as 'celebrities') enhances or embellishes the personality of the celebrities.

If the artificial intelligence deployed was highly sophisticated, the celebrity could remember past interactions, and get bored with standard actions of the ancillary characters, forcing the non – celebrities to attempt ever less likely interactions.

3.4.2 Autonomous Action, Immutable Results
We could allow actors a myriad of actions, as long as their actions achieved the right results (construct Stonehenge, invade Britain, take coffee beans from Arabia to Java, etc). However they transport coffee beans, they have to take these coffee beans at the right time and to the right place.

A theory buzzing through the social sciences-memetics-talks of certain 'killer' ideas that take on a life of their own, using people as carriers rather than as the progenitors. A meme is a popular self-serving cultural concept with no one owner, a cognitive equivalent to Dawkin's description of the 'selfish gene, [2, 6]. This sort of option could simulate the spread of ideas in a memetic way, independent of individual intention, but socially inescapable and inexorable.

3.4.3 Groundhog Day
In the film Groundhog Day, the actor Bill Murray plays a weatherman caught in a time warp, no matter his action he keeps waking up to the same morning. He eventually escapes the time warp by choosing a considerate and unselfish action for the first time in his life. In a similar fashion, a virtual heritage environment could allow actors to choose any action, but only one or a few would allow the historical plotline to move forward. And only the correct interactions would be recorded, although the number of times an actor chooses the wrong action could be counted.

3.4.4 Possible Worlds
This method would allow virtual actors' interaction to change history with the result that actors find themselves in parallel possible worlds. This approach has been heavily used in science fiction (H.G. Well's 'The Time Machine', Black Adder, Bill and Ted's Excellent Adventure, Dr Who, Star Trek, the Canadian film 'Possible Worlds' etc). While fascinating from 'the what' if scenario point of view, it is not likely to be a worthwhile avenue for virtual heritage environments.

3.4.5 Diary of Emotional Development
The main narrative follows historical events but actors are given the opportunity to write down or otherwise record the emotional development and mental states of main character celebrities. Actors might also have the option of recording in multimodal form any events they think are crucial turning points.

While becoming the self-appointed scribes of history might be personally informative, actors are not likely to be highly engaged, as the interactivity is not varied and they do not contribute to the story. Perhaps the celebrities could punish scribes who are too inaccurate? The scribes' stories could be embedded into the virtual environment, and be evaluated and commented on by other scribes.

3.4.6 Surfing Memetic Drift
A meme is a popular self-serving cultural concept with no one owner [2]. Actors have to choose the successful memetic idea, social force, or artifact that changes the world in a significant way. Only if actors choose the correct object or idea can they advance through time and space. Each artifact may trigger other related events that also change history, so the actor can choose from a web of possible associations. If the actor chooses the wrong idea (for example, picks the turkey to represent the United States-it was mooted over the eagle), they might have to endure a video of what happened before being told no, it never actually happened—start again. A database could record the actors' choices against reality, and against previous actors.

3.4.7 Augment History with Real World
It is possible to augment history with annotations of real-world visitation. One could use social agents as guides to trails left by previous visitors who deposit into secret caches videos, sound recordings, or images or the place as they visited it in the real world. Or perhaps their clues get washed around or moved by dynamic environmental forces, and the current actors have to match the 'clues' depicting real places, to where those places are or will be in the virtual travel environment.

For example, a young woman climbs the Himalayas. In the many cyber-cafes of Katmandu or from a PDA with GPS she could email audiovisuals of her path into the virtual environment, which her parents could follow from a computer in their own home. As they watch her photos, they could spin around in the related 3D context of the place she is visiting as it is now (perhaps fed by real-time climatic data) or as it used to be thousands of years ago.

3.4.8 Augmented Cultural Exchange
In a virtual environment, actors could meet other actors, who are actually locals of that site, academic authorities, or computer (or even real) actors that deliberately give misleading accounts of the area and of themselves. The goal could be to identify who are the locals, authorities, and deceivers (agent based or human actors), and what the truth actually is.

3.4.9 Reversed Time Travel
All of the above options are chronological in the typical sense, actors encounter problems, try to solve them, and travel through time as they do so in a forward motion. Yet the scientists' uncovering of the past (and hence the discovery of the content of virtual heritage environments) is looking backwards by thinking backwards. By uncovering fragments, scientists pierce together what happened before and after.

Perhaps if actors find a germane and pivotal artifact, event or action, a portal opens that takes them to the associated past *before* that object. Hence the task is to find doors to the time before rather than to the time after. As people travel further back in time less is known, and there are more possible interpretations, which means actors can interact more and more with the main narrative. The artifacts and records of the actors' own interaction history may become lost, or mythical, or get covered up by 'alternative' histories.

4. More than Texture and Geometry

It has been suggested that Virtual Environment design be informed by architectural and planning theory. Real-world built environments are often vague and amorphously designed, as well as incorporating deliberate illusions to tease evoke or trigger our perceptions and memories.

Architecture involves the thematic linking of spaces (e.g., from inner to outer and the converse), and the placing, using/imagining of objects (as in self and other people) in space. Architecture may also create the appearance of popularity through the illusion of erosion (the apparent passing of time).

It might be argued that CAD packages are directly synonymous with building virtual environments and therefore that virtual environments are architectural. Yet CAD was designed to get buildings built, to quantify rather than qualify the architectural experience. And the real world experiencing of architecture is always mediated through a dynamic and imperfect sensory interface: our minds and our bodies.

Computer reconstructions do not pander to sensory cues, illusions and limitations. The suggestion of dissolution, of mood, of multiple thematic interpretations, or the effect of time and personalization (via erosion) are generally missing from virtual reconstructions. These factors, along with limited interactivity in general, may help explain why few virtual environments are popular or engaging, especially when compared to chat-worlds or to computer games.

5. Metaphors for Historical Reconstructions

Virtual heritage environments can utilize many types of game metaphors.

The classic snake and ladders metaphor can be applied to travel across time and space. In the case of Mayan archaeology, the inhabitants actually believed in portals to a sky world above and an underworld controlled by a lord of death, these portals were either sky-snakes or wells and cracks in the earth. Designers could use these metaphors to allow people to teleport across time and space, (Figure 2).

In many rendering engines, collisions are captured, and avatars have some degree of physics (collision, inertia). Borrowing from the 'Steal the Flag' games, different players with different characters (and hence different capabilities) could gain points or important items by sneaking up and colliding with others.

Many traditions tell of changelings. Players could learn different ways of interacting with the world depending on their character and where that character is sited. In the case of Mayan culture, everyone had spirits that wandered the world at night and fought battles with evil spirits from the bowels of the earth.

Figure 2: Screenshot of Watery Mayan Portal that appears in virtual environment to teleport users.

Perhaps the most powerful way of historical immersion is via role-playing. Although theatre provides a strong metaphor library for virtual environments, improvised theatre is more apt as it requires direct audience interaction while having some plot guidelines. Participants could 'wake up' in social roles and social costumes, and have to gain information from local avatars as to what they look like, who they are, and their role and abilities in that culture.

In some game rendering engines available online it is possible to be in one version of an environment while seeing a player in the same world even if they are at a different computer looking at a different version of the same world. While it may not immediately appear useful, by synchronizing the players and not the world an interesting scenario can be developed. Each player can see each other but is trapped in their own perspective (version) of the world. Only through other players describing their world to them can invisible (unsynchronized) objects appear to the players.

A simpler version of this game would be for players to have avatars invisible to themselves. In order to find out their social role, where they fit in and what they can do, it may be necessary for them to encounter other players in order to have their physical form described to them.

Perhaps the most interesting and most promising metaphor in terms of cultural immersion would be that of the spy game. In this scenario both scripted agents and players are given characters and agendas. Other agents or players are given the task of trying to find out who are the real inhabitants and who are the pretenders through the choice of words, how suspicious their movements or behaviors, or by how long they tarry in a spot without doing what they are supposed to do.

6. Translating Ideas to the Industry

The question will arise as to how these ideas may help the games industry as well as academia. Firstly, it may prove beneficial for gaming designers to work with archaeologists to provide rich and well detailed environments that capture some of the original inhabitants' viewpoints. The academics gain a powerful visualisation environment, the industry gains a foothold into

education markets, a willing audience for evaluation, and domain knowledge experts.

In the role of staging virtual environments, academics would be able to test out various interfaces not commonly available to the public.

7. Staging Interactive Environments

Whether the environment is onsite, online or on view is an important factor in the study of how engaging the content is.

Figure 3: A Fog Screen can be a translucent contextual barrier or projector between an inside viewer and an outside environment (http://www.fogscreen.com).

Onsite interactive environments could use fog instead of screens to display material as a transparent wall between the viewer and the actual site (Figure 3).

In order to improve engagement, online environments may be augmented with real-time data (such as via the Internet). Players and their customized artefacts could be shared and modified via social interaction. Important sites or events could be captured, annotated and saved to their computer or distributed to others.

In classroom or museum environments where the emphasis is on the environment being on view in a public arena, perhaps interaction is the hardest challenge of all. One option may be to allow players to control part of a screen.
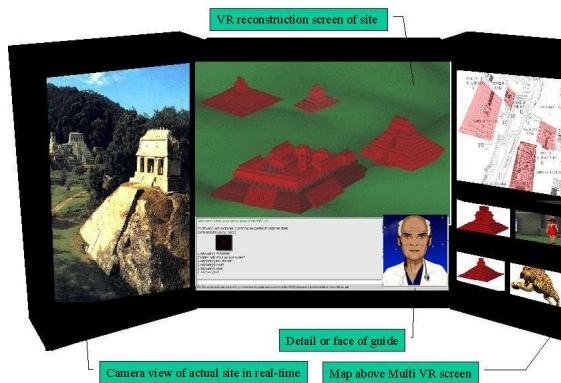
VR Augmented Archaeology Display

Figure 4: Camera, Video-Cam, CAD display.

If there were three walls showing a real-time CAD model of a site, a real-time interview with an onsite expert (say an archaeologist) and multiple movable camera views of the real site; players could control their own tiny camera screen. Or they could ask the expert questions through a chat window, and when asked to contribute, could draw or modify objects in the CAD window screen (Figure 4).

Museums also offer a rich library of real artifacts. These are often buried in the overall hoardings, with invisible conceptual connections to other artefacts in other displays. Using wireless tracking, augmented reality, or tablets, -players could attempt to match artefacts with exhibits or trace the conceptual threads that link artefacts in a manner reminiscent of mazes, and the myth of web of Daedalus that imprisoned the Minotaur.

8. Test Case

We are currently reconstructing the most famous buildings and the terrain of Palenque. The constraints of online computing are utilized in culturally specific ways, for example, portals are used both to load virtual settings separately (rather than immediately as one large world) and to convey the Mayan belief in portals to the Underworld and to their Sky ancestors.

Figure 5: Night and Day in Palenque.

Other Mayan beliefs include spirit companions, which are used as potential tourist guides and alternative avatars (with their own distinct form of travel). Collision is used to constrain the visitors' path through parts of the environment. Fog and glare are used as navigation and atmosphere devices, as well as being used to indicate gaps or controversies in current archaeological knowledge. Fog also reduces the never-ending space feeling of large virtual environments, and can indicate the passing of time (Figure 5). Glare, dynamic light sources and positional sound can be used as navigation cues. Some acoustic and visual events randomly occur, or are triggered by certain user actions.

Avatars (three-dimensional representations of visitors) are sized according to the dimensions of the locals, so visitors can experience the difference in scale as seen by the local inhabitants. Each avatar also has specific gestures that can be triggered by certain events or places in the environment or controlled by the visitor.

There is also the ability to collect artifacts, answer the riddles of local inhabitants (via artificial intelligence), while mouse-over functionality provides users with information when they want it, rather than having to follow a predetermined sequence.

There will be three different environments and tasks to ascertain whether performance data is a reliable indicator of engagement, if certain interactive elements create a better sense of place than

others, and if game-style interaction interferes with the learning process.

9. Conclusion

There are at least three major issues facing the design of virtual heritage environments, realism, contextual interaction, and narrative freedom.

Many virtual environments have aimed for realism rather than for meaningful interaction. Yet this may not be the most effective means of educating and engaging the general public.

Culture is not a collection of facts; it is an embodied and embedded dynamic world-view, an interface to social ideas and beliefs. This interface allows us to visualize our cultural understanding and transmit it to others for review and feedback. If culture is an interactive process of observation instruction and participation we need to know how to meaningfully replicate this process in virtual environments. It may prove easier to evoke this world-view through vagueness and uncertainty rather than through clear and unbiased vision.

In order to do so, we may learn from game-style interaction. The elements that make three dimensional games engaging (embodiment, cultural embedding, personalised maps, interactive artifacts, dynamic environments, mood, and contextual tasks) may be extended and applied to virtual heritage environments.

However, unlike many games, virtual heritage environments have a set narrative to tell. How do we allow the freedom of interaction and personalization along with the unveiling of history through one or more narratives? Can we infuse written history with multiple personal and cultural perspectives? This paper suggested nine different methods, but there are certainly far more to be discovered.

In order to facilitate cultural understanding, architectural reconstructions and virtual heritage environments must provide more than visualisation or interactive navigation. They require some form of social learning, they must be personalizable, and allow some degree of culturally specific embodiment. In order to be engaging, virtual heritage needs to study how games are engaging through interaction, setting of mood, and contextual embodiment, but in such a way that the content is meaningfully understood rather than used as a mere backdrop.

10. ACKNOWLEDGMENTS

11. REFERENCES

[1] Amory, A., Naicker, K., Vincent, J. and Adams, C. The use of computer games as an educational tool: identification of appropriate game types and game elements. In *British Journal of Educational Technology*, 30 (4), 1999, 311-321.

[2] Aunger, R. Darwinising Culture: *The Status of Memetics As A Science*. Oxford University Press, Oxford, 2000.

[3] Bryce, J., Rutter, J. Presence in Public Computer Gaming. Presented at *Computer Games & Digital Textualities*, IT University of Copenhagen, March 2001.
http://www.digiplay.org.uk/Game.php

[4] Champion, E., and Dave, B. (2002). Where is This Place? In *Proceedings of ACADIA 2002: Thresholds Between Physical and Virtual*. Ed. by G. Proctor. 2002, 87-97.

[5] Champion, E. Applying game design theory to virtual heritage environments. In *Graphite03, Proceedings of the 1st international conference on Computer graphics and interactive techniques in Australasia and South East Asia*, ACM Press, New York USA, 2003, 273 – 274.

[6] Dawkins, R. *The Selfish Gene.* Oxford University Press, Oxford, 1976.

[7] Eiteljorg, H. Photorealistic Visualizations May Be Too Good. In CSA Newsletter, Fall, 1998, Vol. XI, No. 2.

[8] Fencott, C. Content and Creativity in Virtual Environment Design. Presented at *Virtual Systems and Multimedia '99 (VSMM'99)*, University of Abertay Dundee, Scotland, 1999.

[9] Gadamer, H. (translated by David E. Linge), *Philosophical Hermeneutic*s. University of California Press, California, 1976.

[10] Juul, J. The repeatedly lost art of studying games Review of Elliott M. Avedon & Brian Sutton-Smith (ed.): *The Study of Games.* New York: John Wiley & Sons, Inc.1971. Online at http://www.gamestudies.org, Game Studies issue 1 July 2001.

[11] Laird, J. E. Using Computer Game to Develop Advanced AI. In *Computer*, 34 (7), July 2001, 70-75.

[12] Laird, J. E., van Lent, M. Human-level AI's Killer Application: Interactive Computer Games. Invited talk at the *National Conference on Artificial Intelligence (AAAI)*, August 2, 2000.

[13] Massey, D. A Global Sense of Place. In *Marxism Today* re-printed in *Studying culture: an introductory reader.* Ed. by A. Gray and J. McGuigan. E. Arnold, New York, 1993.

[14] Mosaker, L. Visualizing historical knowledge using VR technology. In *Digital Creativity* S&Z 12:1, 2000.

[15] Murray, J. H. *Hamlet on the holodeck: the future of narrative in cyberspac*e. New York: Free Press, 1997.

[16] Sardar, Z., and Ravetz, J. (eds.) *Cyberfutures: Culture and Politics on the Information Superhighway.* London, Pluto Press 1996.

[17] Schiffer, M. B., and Miller, A. R. *The Material Life of Human Beings Artifacts, Behaviour and Communication.* London; New York: Routledge 1999.

[18] Schroeder, R. *Possible worlds: the social dynamic of virtual reality technology.* Westview Press, Boulder, Colorado, 1996.

[19] Schubert, T., Regenbrecht, H., Friedmann, F. Real and Illusory Interaction Enhance Presence in Virtual Environments. In *Presence 2000*. 3rd International Workshop on Presence, 2000.

[20] Schuemie, M.J., Van Der Straaten, P., Krijn, M. Research on Presence in VR: a Survey. In *Cyberpsychology and Behavior*, Delft, 7 Jan 2001.

[21] Slater, M. Measuring presence: A response to the Witmer and Singer questionnaire. In *Presence: Teleoperators and Virtual Environments*, 8(5), 1999, 560-566.