

# Indiana Jones & the Joystick of Doom: Understanding the Past via Computer Games

Creating virtual heritage environments that are both engaging and educational is a challenging process. Digital archaeological reconstruction has been concerned with exact replication of facts rather than with understanding, 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 educational potential of virtual environments. Would using interactive game techniques and technologies in heritage projects 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?

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## 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.<sup>1</sup> 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.<sup>2</sup>

In this article I will discuss three key problems in designing virtual environments that in some way depict the values of past cultures.<sup>3</sup> 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 goal is often seen as limited by technical constraints such as the speed of the Internet or network connection, limited processing power, or the computer’s capacity to render a large number of objects on the screen in real-time, which are seen to impede the production of realistic virtual scenes. In contrast, this article emphasises the need to foster engagement not through realism but through interaction.

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? Is it useful, desirable or even possible to interact with digital reconstructions of different cultures in a meaningful way? Culture understood from the distance of a hotel or guidebook is obviously not the same as the culture that guides, constrains and nourishes a local inhabitant. I would like to bring the same distinction to culture experienced through virtual environments, and argue that a virtual traveller is not the same as a virtual tourist. Despite or perhaps because they have a goal to solve, and have more constraints and more direct immersion in the local way of doing things, people who travel rather than tour arguably have richer and more interesting experiences.

Thirdly, if we do manage to create an engaging and believable virtual environment, will the novelty or entertainment value actually interfere with the cultural understanding gained by the users? In virtual heritage environments this is particularly evident in the conflict between individual freedom to explore and the more pragmatic 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?

## VIRTUAL ENVIRONMENTS

Virtual environments have been explored and described in science fiction and fantasy literature. Examples of these ‘worlds’ are Neal Stephenson’s *Metaverse* and William Gibson’s *Cyberspace* or the *Matrix* series. These virtual environments are popularly depicted in terms of sensory overload, and are often pervaded by a sense of a mysterious and evil alien intelligence. Another popular and popularly known form of virtual environment is the online community chat room. Typically, the avatar (a character that represents the user on screen) can move around in these three-dimensional environments. A panel tells you who else is currently ‘in’ the environment, and there is a ‘chatpane’ where you can type and read ‘chat’ between the users. In a few, like *ActiveWorlds*, people can even build their own houses. These environments have their critics though; some have written that the three-dimensional component does not add to the social interaction and that if the background environment is merely a stage-set (i.e. the participants cannot modify it) one might as well use a text-based chatroom.<sup>4</sup>

Other virtual environments include those designed for education purposes, such as the highly successful computer-based training programs and learning environments. Flight simulator games are popular in game arcades and in the home, and also as training programs in the military. Virtual environment-based games are used by the military because they can be re-enacted anywhere, you can focus on certain things to be learned, evaluation can be built into the simulator, virtual missiles cost less than real ones, and you don’t have to lose real soldiers in a virtual combat. For example, one of the major research partners behind the Web3D consortium (which creates a standard for 3D objects and programming on the Internet) is the Naval Postgraduate School at Monterey California.

There are even virtual environments designed to divert the attention of burns patients during surgery. Brain scan studies have shown the patients are not as aware of the pain when immersed in these virtual environments. Psychologists also use virtual environments to cure patients of phobias. These virtual environments do not need high resolution and visual fidelity as the phobias are so strong they compel the patient to react even to virtual stimuli. The success of these clinical and therapeutic environments is evidence that highly realistic environments are not as important as the psychological impact of the elements and interactivity contained within.

My own research focuses on computer-based three-dimensional reconstructions of historically significant artefacts and built landscapes. These virtual heritage environments are typically archaeological reconstructions of past cultural settlements designed to help our visualisation of past objects rather than ‘embed’ us in past cultural values. Some virtual 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 in its infancy and there is still confusion and debate as to the meanings of ‘immersion’ and ‘presence’, and hence research has tended to be driven by task rather than by context. The majority of presence research has not concentrated on how engaged and involved users are, but on whether they are sufficiently seduced into thinking they are in a real place.<sup>5</sup>

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.<sup>6</sup> Questionnaire-survey results of people viewing state-of-the-art virtual reality-based exhibitions in Italian and Greek museums indicate that realistic environments can bore people if they do not have interactivity, tasks, and some idea of other people (also known as agency); these are all features of popular computer games.

Perhaps part of the problem is that designers have not fully explored how people can interact with virtual environments in engaging and educational ways. Advances in digital technology have tempted many to approach the holy grail of photo-realism. The challenge of visual fidelity may have obscured the pursuit for not just usable but also useful virtual environments. As the archaeologist Mark Gillings noted: ‘Researchers and commentators have not yet begun to grapple with the question: What does it actually mean to describe something as ‘virtually real’? It is my contention that until they do, the unique potential VR has to change the way we approach, study and think about the physical world will not be fully exploited.’<sup>7</sup> In other words, there is still much research to be done on achieving inspiring and useful context and meaning in digital media. For effective learning via virtual environments, it would be useful for research to provide us with information on engaging ‘triggers’ for highly effective interfaces that stimulate the participant’s engagement. Such triggers may include the recreation of native tools, locally specific goals, and a sense of embodiment during interaction through the use of avatars that are affected by gravity and collisions with other objects.

## INERT ‘EXPLORATIVE’ ENVIRONMENTS

The first and most common type of three-dimensional virtual environment available on the Internet is the visual environment (which sometimes includes sound). An extension of the scripting language HTML used to write web pages was created in the 1990s to enable the sense of three-dimensional objects on a webpage. This language was called VRML (and confusingly either pronounced V–R–M–L or ‘Virmil’). It was difficult for non-programmers to learn and required a great deal of effort to make interactive. And worse, it was very slow. One of the much hyped technologies of the Internet, it never truly took off.

VRML environments are good examples of the limited interactivity of virtual environments that target visualisation. One can walk around objects, magnify the view or pan the camera around objects such as buildings, and occasionally move between preset viewpoints. Orientation and view are often manipulatable, but the environment is not really interactive as it cannot be modified by participants. Visualisation-based environments do have their uses. For example, they can be used to create a three-dimensional fly-through of a building for an architect’s clients. The advantage and disadvantage is that the environment is really only a finished product: it is not affected by inhabitants, and so manages to be definitive, immutable, and appear consistent in appearance.

Due to the success of these architectural computing-based models, it has been suggested that virtual environment design be informed by architectural and planning theory.<sup>8</sup> It might be argued that Computer Aided Draughting (CAD) applications are directly synonymous with building three-dimensional digital environments and therefore the CAD programs used by architects are tailor-made for designing virtual environments. The problem is that CAD programs were designed to get buildings built—to quantify rather than qualify the architectural experience. They show static additions to the environment rather than environmental changes acting and interacting over time. There is no fog, no dirt, no wind, and often even no people. Yet the real world experience of architecture is always mediated through a dynamic and imperfect sensory interface: our minds and our bodies. Computer reconstructions created from CAD programs typically do not allow for sensory cues, illusions and limitations. The suggestion of dissolution of form, of mood (often through dramatic lighting), of multiple thematic interpretations, or the effect of time and personalisation (via erosion) are generally missing from virtual reconstructions. These factors, along with limited

interactivity in general, may help explain why few virtual heritage environments created using CAD programs are popular or engaging, especially when compared to chat-worlds or to computer games.

The lack of atmosphere resultant from both VRML and CAD applications is not the only issue. Virtual heritage environments are designed to preserve historically significant archaeological sites. Conserving and preserving a sense of history is an important and difficult task. Part of the problem is that history is not a static and immutable object but a dynamic mass of interpretations, actions, intentions and beliefs. One critical theorist has written a polemic attack on virtual heritage projects for rendering history and historical cultures in this one-dimensional and one-sided way:

*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.<sup>9</sup>*

Many virtual heritage sites have brilliantly detailed temples, but are missing the element that 'places' the temple in its context. That missing element is people, and the driving forces that compelled them to inhabit and modify their 'world'. Every group of people has its own viewpoints, issues, and outlook on the world. Without understanding this specific cultural agency, there is a danger that we may see the virtual heritage site only in terms of our own cultural perspective. This limited ability to represent social processes and 'intangible' heritage can create a second danger: the static and apparently immutable aspect of digital reconstruction can imply a certainty of knowledge that we actually do not possess. In addition, many scientifically accurate virtual heritage environments lack the ability to store interaction history. A truly interactive environment is affected by the actions and paths taken by its visitors, yet many virtual environments do not record traces of what has happened. Visitors may be able to change part of the environment but seldom does the environment 'remember' the visitors, their paths, actions or discoveries. For these

reasons, visualisation-based environments such as those designed using VRML and CAD applications are of limited use in designing virtual heritage environments which aim to conserve and preserve history.

### ACTIVITY-BASED ENVIRONMENTS

Activity-based virtual environments allow activities to take place. Many are games or training programs. More than merely a straight visualisation of objects, an activity-based virtual environment allows one or more users to alter some character or element in pursuit of a defined goal. Examples of activity-based environments include video games such as Pacman, Tic-tac-toe and Microsoft's Flight Simulator game. Activity-based virtual environments are arguably the most commercially successful type of virtual environment.

The technological limitations of Internet-available visualisation-based virtual environments such as VRML 'worlds' do not seem to have hindered the popularity of complex games. The most popular form of virtual environment is arguably the computer game. Entertainment software is the fastest growing of all types of entertainment, even outselling films. The computing power of current game consoles also rivals supercomputers used a mere decade ago. Computer games are also used for research into artificial intelligence.<sup>10</sup>

Games can have an 'atmosphere', tasks to complete, navigation reminders, inventories, records of interaction history (such as damage to surroundings) and social agency (such as real or computer directed opponents). Most popular games contain a personalised representation of the user (an avatar) and similar representations of allies and opponents. There are also several features of games that are conducive to learning. 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. As participants become 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 such as scores and status points. Furthermore, games cater to the learning curves of new users by advancing in complexity over time, and can be personalised.

To explore both the possibilities and limitations of the games model for virtual heritage environments, I will turn to the computer adventure game Heretic 2 as it is analogous in form to a virtual heritage environment. Only, in addition to being a virtual heritage environment,

Heretic 2 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 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 artefacts, find 'power-ups' to boost health and combat ability, and survive being attacked by creatures with various weapons and abilities. 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, or running out of air (by staying underwater too long).

What techniques does Heretic 2 use to engage the user? Using Clive Fencott's terms,<sup>11</sup> I will provide a brief analysis of the game. Heretic 2 uses attractors that promote phototropia (such as glints of light) and the prospect of open spaces to direct people to the next part of the adventure. Its repellers include aliens that guard power-ups and narrow passageways. To aid navigation and stress the range of movement and terrain, Heretic 2 provides connectors in the form of ropes, water portals and crates that can be used as steps. The sureties are the constants in the game: hostile creatures, power-ups (to recharge your health), water, land and molten lava. Constraints include periodic fainting, occasional route restrictions (every so often users have to follow certain paths) and initial weapons limitations (adventurers start with only a staff so they will be on the lookout for more powerful weapons). Affordances, or items that aid the journey, are the ropes, weapons, power-ups, levers, tools, buttons, ledges, rubble (closed doors) and sliding doors.

I have suggested that people who wish to 'travel' rather than 'tour' through virtual heritage environments may require social agency, changing landscapes and climate, culturally appropriate tools and a task to complete. Heretic 2 has dynamically attenuating physiological zones that record interaction history: the environment can kill you and it remembers where you have used weapons, the people you have killed and the artefacts you have modified. It also affords avatar dialogue which means you can adventure online with like-minded players, artefact-related tasks to help direct the player to the main goal, and a mostly static two-dimensional map that indicates the player's position. These features of Heretic 2 could be effectively utilised in the design of virtual heritage environments.

## THE INDIANA JONES QUANDARY

Virtual heritage environments may well need the above interactive features and more in order to be engaging. Yet despite the detailing of environments, agents, and artefacts, Heretic 2 does not have a rich sense of cultural immersion. This is due to the features it shares with other mainstream computer games: the only goals are collecting artefacts and vanquishing 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. Adventure games are tainted by the 'Indiana Jones' quandary: archaeology is glorified via popular culture, not for preservation but for the exploration of novelty and the demonisation and destruction of other cultural perspectives. Indiana Jones films routinely involve an eclectic mix of historical and priceless artefacts that are destroyed by Indiana Jones' race against time, or for just getting in the way of him and his extremely violent archaeological rivals.

Yet these films also help popularise archaeology, even if they promote the destruction of the very objects archaeologists are supposed to respect and preserve. The wanton destruction of cultural settings is also apparent in the films based on the Lara Croft Tomb Raider computer game. The first film was set in Angkor Wat, and computer graphics-based fight scenes in the film portrayed the sacred temple complex as a shooting gallery rather than a religious precinct. In a similar way, 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'.<sup>12</sup>

## PLACE & CULTURAL PRESENCE: THE HERMENEUTIC ENVIRONMENT

'Place' is an important concept for virtual heritage environment design. For Doreen Massey, 'place' may have any of the following features: a record of social processes, fluid boundaries, and internal conflicts.<sup>13</sup> A place leaves 'traces' of the people who saw and used it as a place, or it has features that communicate something to us about how we see our place in the world. 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. 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?

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), we need to have more than merely identifiable or activity-based virtual environments. 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. If we wish to remove the sense of heritage sites as an object in a glass cage—a 'cyberspace'—then we should aim for designing the sense of an external cultural presence. For participants to experience cultural presence, they must feel that they are becoming part of a culture, that what they believe can be transmitted, recognised and socially acknowledged 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 an artwork. 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: '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.'<sup>14</sup> Where our environment refers to a long-extinct civilisation, such a bridging is perhaps impossible unless we can somehow 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 to whom we are socially bound.

Some have argued that culture is a learning and recording process. Researchers believe we learn about a culture through participating in the interactions between three major elements: the cultural setting, a place that indicates certain types of social behaviour; artefacts and how they are used; and people, who provide a social background and teach you how to behave through dialogue devices such as stories and commands. We could paraphrase the above and suggest that cultural learning is derived from interactions between places, objects and people. In this definition, the cultural is a subset and 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 and use them in reference to that perceived social meaning.<sup>15</sup>

When using the games model to design virtual heritage environments, particular attention must be paid to issues of cultural

presence and the feeling of place, and the techniques borrowed from games models should be modified accordingly. In games, artefacts are predominantly used for conflict and destruction; in the virtual heritage environment, artefacts would be used for other purposes. A typical component of games is the time-based task, which effectively means people are 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 by designing timed sections that are triggered by significant events. We could also allow the option of replays so that people can reflect on what they had done. However, these strategies, which might entail periods of time constraints and then periods without time constraints, could be a problem for the pace and suspense of the experience. Perhaps most importantly, if the virtual environment shows changes over time (something multimedia is brilliant for), historical accuracy in these changes is important for educational reasons, and this may be in conflict with the user's demands for autonomy and control. Virtual tourists want an opportunity to interact with history and to choose 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.

#### TEST CASE: PALENQUE MEXICO

Tackling the above issues is the motivation for my research into virtual travel environments. I attempt to isolate and evaluate the types of interactivity people prefer when visiting three-dimensional virtual heritage environments. My site is Palenque, Mexico, and the great majority of the artefacts of that 'city of inscriptions' are simply no longer there. However the Internet can bring the landscape, the buildings, the artefacts, reasonably accurate reconstructions of the native music, representative animated avatars of the people, and past historical and environmental conditions all together in one multimodal interactive gestalt. And it is deliverable over the Internet.

Virtual travel may not be like being there, but it may in fact be even more educational. If we wish to understand how such ancient people as the Mayans of Palenque thought, believed and acted, we need a non-realistic world. They saw, imagined and related to things in a way a Westerner will not understand by merely viewing the current remains of their past abode. In order to understand locals we need to work, travel and live under similar physical and cultural constraints to them. This is where



**FIGURE 1** A chat-guide based mode (Temple of the Foliated Cross).

virtual heritage environments are useful. Earlier, I defined travellers as people who do not just tour places (without having to leave their creature comforts) but who have to experience local conditions

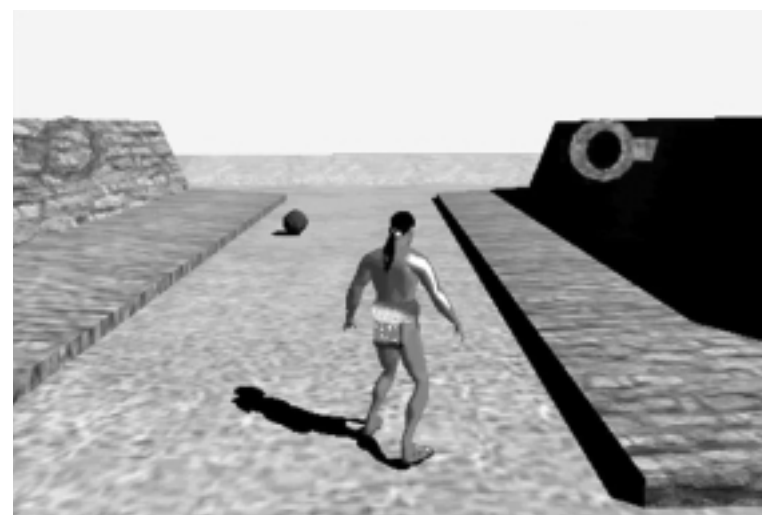
in order to get from A to B or to complete a task. Tourists, on the other hand, view the world from the air-conditioned comfort of their own portable culture. I believe the traveller-mode—where people are embodied (physically dependent or affected by their environment) and embedded (socially affected by the local social structure)—is more engaging than the tourist mode and should be the model used to enhance the feeling of cultural presence in virtual heritage environments.

From measured archaeological drawings, site surveys and photos I have created three-dimensional models of the most famous buildings and the terrain of Palenque. The constraints of online computing are managed in ways that draw on Mayan culture; 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. Similarly, the ‘spirit companions’, another component of Mayan belief, are used as potential tourist guides and alternative avatars (with their own distinct form of travel). Collision is used to constrain the visitor’s 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 feeling of never-ending space common in large virtual environments, and can indicate the passing of time. Glare, dynamic light sources and positional sound can be used as navigation cues. Some acoustic and visual events occur randomly, and some are triggered by certain user actions.

Avatars 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. Visitors also have the ability to collect artefacts and answer the riddles of local inhabitants (via artificial intelligence), while mouse-over functionality provides users with information when they want it, rather than requiring them to follow a predetermined sequence.

There are three different interaction modes. One mode is action-based, and the participants have to push back slabs to find the hidden tomb (this was actually how the Tomb of Pakal under the Temple of Inscriptions was discovered). If they manage to push back the sarcophagus lid of Pakal when they reach the tomb, a portal appears that takes them to a reconstruction of Palenque’s Ballcourt. The Mayan Ballcourt symbolised war, life and death, the growth of maize, and the victory of the Mayan ancestors over the Lords of the Underworld, Xibalba. The second mode is observation-based only, and participants are asked to find artefacts located in the large and navigationally confusing Palace. In the third mode, the three major temples of the Cross Group have scripted guides, representing a Mexican tour guide, King Pakal, and his son. Their movements and speech are proximity-based, and they get angry or fall over if participants run into them. The goal of this mode is to click and read information relating to the giant inscribed tablets in each of the Temples.

Evaluations have been conducted in three stages consisting of an initial pilot study followed by two evaluation groups. The pilot study comprised a first-year archaeology class of forty-three students studying Mayan culture, and the second evaluation comprised twenty-four more-experienced participants who were either virtual environment designers or cultural historians with an interest in virtual heritage. In the third stage, which is yet to be completed, twelve people from Lonely Planet



**FIGURE 2** An imaginative reconstruction (the Palenque Ballcourt).



**FIGURE 3** An activity-based mode (Temple of Inscriptions).

Publications (a travel publications company with a strong web-based presence) will be tested. In this last evaluation, the three interactivity modes will be swapped around to ensure the findings are not affected by the different content of the three environments tested.

The first objective of my study is to compare different types of interaction—observing and finding items of information, gaining information from scripted social chat-guides, and more game-style interaction involving spatial manipulation of the avatar and moving objects—to see if they affect the cultural learning of the participants. The second objective is to compare various types of evaluation to see if some are more useful than others.

In order to assess game-style interaction and realism versus context, four more imaginative and less authentic ‘worlds’ were created based on the cultural perspectives of the ancient Mayans in Palenque. These four worlds are a Mayan Ballcourt, a Mayan underground cenote with ceremonial offerings, a Mayan peasant Village (Milpas) and a recreation of the Crocodile-Mountain of the Mayan world-creation myth. In the

Ballcourt people have to play Mayan football, in the cenote participants have to find and deposit offerings, in the jungle they have to find the Mayan village and the maize (corn), and in the last world they have to find the World-Tree and catch up to the ‘paddler-gods’ rowing around the base of the Crocodile-Mountain. Since the imaginative worlds are more game-oriented, the evaluation hopes to find out if the games are more engaging or considered closer to a Mayan perspective than the archaeological environments.

The evaluation uses five different methods. The participants’ recall of the archaeological environments is tested with six multiple-choice questions for each interaction mode. Their ability to find information in the environment is recorded, and they are asked to rank the environments from 1–7 against a range of questions aiming to assess the environments for presence and interactivity which are shown in Figure 4.

*Please rank in descending order from one for highest to seven for lowest your preferred environment.*

**Feature: (In) which virtual environment...**

Did you find the most challenging to explore, find or change things?
Was the most interesting to you?
Seemed most interactive to you?
Did you feel most closely represented the way Mayans saw their own world?
Most effectively seemed inhabited by real people?
Most felt like you were in the presence of Mayan culture?

**FIGURE 4** Interactivity Survey

Participants are also asked to rank the environments in terms of frame-rate (speed) and how quickly time seems to pass by. Finally, they are tested on what they observe in the environments, such as shadows, relative height of backpackers versus Mayans, and how many real or scripted people they notice in the environment.

While it was expected that the activity-based world would be the most successful at prompting participants to remember information, findings so far indicate that the observation-based world is more memorable than the activity-based or chat-guide based worlds. The tasks in the chat-based world have the highest completion rate, yet participants find the chat-guide based world the most challenging, followed by the activity-based world. It is likely that navigation rather than interaction severely curtails or aids understanding. More conclusive findings on

interaction will hopefully be reached when the evaluation reaches stage three and the interaction modes are switched.

The first-year students were also much more interested than cultural historians and visualisation experts in changing avatars and talking to other people. However, the students were not very interested in studying the artefacts or even in answering the questions or reading the information, despite studying the culture in class. Those with games-based experience also wanted to know if there were weapons and if there was anything to destroy.

There have also been conflicting results between the game-style and imaginative worlds. While game-style interaction (such as in the Mayan Ballcourt) is quickly and eagerly taken up by people, very few think that the game-style environments shows the Mayan cultural perspective. And while most people prefer the archaeological worlds for understanding the culture and say they are more interesting and interactive, it is much harder to get them to leave the imaginative game-based worlds. Perhaps we should not trust the reliability of questionnaires. Moreover, perhaps the game genre can be intuitive but also impede cultural learning; those with computer-gaming experience who finish the tasks more quickly do not score better in observing aspects of the environment.

## 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. This research project has attempted to research contextual interaction and its effect on cultural learning. If culture is an interactive process of observation, instruction and participation, we need to know how to meaningfully replicate this process in virtual environments. This case study has attempted to borrow from game-style interaction in order to answer this question and to improve engagement in virtual environments. The statistical calculations have not yet been completed so the findings are still inconclusive. However, they do suggest that issues of evaluating virtual environments are highly significant and may impede research, and that game-style interaction, being so task-focused, may not immediately help us with genuinely culturally-appropriate contextual interaction nor fully augment the cultural learning experience.

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## ENDNOTES

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- <sup>3</sup> This article is a revised version of a paper by Erik Champion, 'Heritage role playing: History as an interactive digital game', *Australian Workshop on Interactive Entertainment*, workshop proceedings, Yusuf Pisan (ed.), Creativity and Cognition Studios Press, Sydney, 2004, 29–36.
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