Online Exploration of Mayan Culture

Erik Champion
Department of Geomatics, and
Faculty of Architecture Building and Planning
The University of Melbourne VIC 3010
Australia
e.champion@pgrad.unimelb.edu.au

Abstract
This paper discusses various interactive techniques for online exploration of archaeological reconstructions using a specific JavaScript and XML based application. Specifically this paper focuses on a current research reconstruction of the Mayan city of Palenque set in the Chiapas, Mexico, which aims to evaluate user engagement immersion and understanding of certain ‘embedded’ cultural artifacts and settings. The testbed for the ongoing research is the evaluation of a virtual archaeology project in Palenque Mexico using theories of cultural immersion as well as computer game engine technology and techniques.

Introduction
This paper argues that issues with currently available virtual environment technology affect a sense of engagement in virtual heritage projects. The paper then proposes that many of these issues are addressable by game design. The solution outlined in this paper is to apply interactive mechanisms used in games to virtual heritage environments. The result will allow for a more culturally immersive learning environment. Further, it may be possible that interactive mechanisms can be used for evaluation of user engagement without simultaneously interrupting the user’s feeling of engagement.

Engagement in Virtual Heritage Applications
The starting premise for this research project is that certain interactive elements offer the most engagement in a digital simulation of a cultural environment.
Various researchers have suggested that virtual environments (specifically heritage environments) often lack several features that would make them more engaging to the general public. These missing features include a perceived social presence, a sense of physical embodiment, a lack of handy proximity-based information, contrasting information and narratives, meaningful ‘sited’ movement, the ability to personalize the environment or adjust the complexity of the interface, a sense of place as being specific and unique, and contextual affordances and constraints [1].

As well as inheriting the above problems, one may argue that the lack of public engagement in virtual heritage environments is due to a lack of realism, to inadequate fidelity of recording or displaying technology.

I suggest it is rather with a lack of meaningful content that contextually places the virtual environment in an engaging way. If the purpose of virtual heritage models is to preserve the
culturally significant articles of the past, they must demonstrate the reasons for simulating that past material culture. I suggest virtual heritage environments may sometimes lack meaningful content necessary for a sense of cultural presence.

The recent developments of highly accurate and large-scale virtual heritage scanning technology indicate that the impedance to public use of virtual heritage models is not a problem with capturing realism. Research has further indicated that the general public does not want realism but entertaining immersion [2].

Virtual environments exist with photo-realistic laser-scanned artefacts, augmented by textures scanned in from real-world materials. Yet some have argued that to understand a ‘place’, photo-realism is not essential [3]. Therefore my hypothesis is that the reason why virtual heritage environments lack a sense of engagement is not so much that they have lacked photo-realism, but that they lack the interactive elements that have made computer games so popular.

**The notion of culture**

Visualisation has been defined as “to form a mental image of something incapable of being viewed or not at that moment visible… (Collins Dictionary)...a tool or method for interpreting image data fed into a computer and for generating images from complex multi-dimensional data sets” [4]¹

In virtual heritage projects, the aim to is to visualize a culture through its artifacts when that culture is no longer with us, so ingrained that we do not normally notice or appreciate it, or currently inaccessible or scattered. Virtual heritage is thus a ‘visualisation’ or ‘recreation’ of culture.

There are many issues in the presentation of culture. One is the definition of culture itself, the second is understanding how culture is transmitted, and the third is how to transmit this cultural knowledge to people from another culture. In the case of virtual heritage, a forth is how this cultural knowledge can be transmitted digitally.

If the cultural geographer Yi-Fu Tuan is to be believed, culture is that which is not seen (“Seeing what is not there lies at the foundation of all human culture”). He has further defined culture as a shared form of escapism, [5]. Such a definition raises an interesting paradox for the visualisation of past cultures.

Researchers such as Schiffer and Miller believe we learn about a culture through dynamically participating in the interactions between a cultural setting (a place that indicates certain types of social behavior); artifacts (and how they are used); as well as by people teaching you a social background and how to behave (through dialogue devices such as stories and commands) along with your own personal motives, [6]. In summary, culture requires a setting, artifacts, avatars (or other representations of social agents) and locally appropriate tasks, [7].²

A culturally constraining environment with task-related artifacts as used by social agents is missing from the majority of virtual heritage environments. Social immersion is a powerful mechanism for creating a sense of engagement. However, without artifacts and a shared understanding of tasks, the presence of others only allows social behavior and not culturally specific behavior to occur.

Schiffer and Miller argue that even though only 6-7.7 per cent of major research journals in anthropology deal with artifacts or technology, “every realm of human behavior and communication involves people-artifact interactions”. Cultural behavior in an environment without modifiable or movable artifacts will thus be extremely limited, as a great of cultural transmission is through “people-artifact interactions”.
The social agents also require an environment that interacts with them in order for a region to develop into a cultural setting. Without a shared understanding of setting, the appropriate (time and space-specific) use of artifacts will be more difficult to learn. The process of cultural dissemination requires a notion of place.

**Culturally Specific Places**

We can argue that for creating a virtual heritage environment with a notion of a ‘place’ (a region recognizable to a user as a culturally coded setting) that we need to have more than merely identifiable or evocative virtual environments. Instead we need to create a virtual environment that evokes and identifies a place that carries cultural indications of inhabitation driven by a different cultural perspective to that of our own. A virtual heritage environment must allow us to see through the eyes of the original inhabitants, [8].

This virtual place should suggest ideas of thematically related events, evidence of social autonomy, notions of territorial possession and shelter, and focal points of artefactual possession. In other words, the virtual environment must provide a perspective of a past culture to a user normally only deduced by trained archaeologists and anthropologists from material remains (fossils, pottery shards, ruins, etc).

**Presence**

Professor Mel Slater defines presence (as opposed to immersion) as “The extent to which the VE becomes the dominant one - i.e., that participants will tend to respond to events in the VE rather than in the real world...[and also]...The extent to which participants, after the VE experience, remember it as having visited a place rather than just having seen images generated by a computer...they had an experience of being in a place, just like any other place they had been earlier in the day.” [9].

He also says presence is achieved when arises “...the looming response - the participants know that there’s nothing there but they still duck ... “. In a virtual heritage environment however, we can surmise that a form of cultural presence is reached, when the participants react instinctively to presented phenomena in a way suited to the local (virtual) culture, and not in terms of their own native social habits.

Presence is usually evaluated using questionnaires, but this is not always available at a large-scale to virtual heritage environment designers. Further, questionnaires interrupt the engagement of participants or are used at the end of the experience rather than during the experience itself. In Slater’s words:

“This ‘experiencing-as-a-place’ is very much what I have tried to convey as a meaning of presence in virtual environments: people are ‘there’, they respond to what is ‘there’, and they remember it as a ‘place’. If during the virtual environment experience it were possible to ask the question ‘where are you?’ - an answer describing the virtual place would be a sign of presence. However, this question cannot be asked - without itself raising the contradiction between where they know themselves to be and the virtual place that their real senses are experiencing.”

**Feedback**

Virtual environments in popular literature are often personified in terms of sensory overload (from the Matrix to Neuromancer they stem in effect from examples of the mathematical and dynamic sublime cited in Kant’s Critique of Judgment). However, creating vast amount of information requires vast amounts of processing power. Instead, it would be useful for research to provide us with information on engaging ‘triggers’ so that only highly
effective interfaces are needed to 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 collision, acoustic feedback etc).

**Possible Solutions**

**Evaluate Audience Market**

People may be travelers or tourists. They may wish to loiter, be guided, or seek out certain views or tasks. They may differ in their purpose (goal), in their preference for mythology or history, ability to navigate or solve complex tasks, and desire to personalize the environment or socialize with other avatars.

It may be necessary to evaluate the effect of interactive components on engagement in virtual environments; assess the popularity of ‘travel’ versus ‘tourist’ levels of interactivity, and compare the survey method of evaluation versus inbuilt interactive recording mechanisms.

**Computer Games**

Writers have already argued that virtual environments lack meaningful interaction, especially as compared to games, [10]. Hence I propose that certain features of game technology may be satisfactorily used to create a more interactive and hence more engaging virtual environment.

Highly interactive, games offer built-in assessment of task performance so they are suitable for evaluations of navigation and manipulation through complex spaces. Hence games are often used in education for ‘parallel thinking.’ Games remember you and can be personalized. In terms of technology they offer economy of size, hardware support (acceleration), cutting-edge graphic rendering and artificial intelligence, dedicated user forum-based help, multi-platform code and networking.

However there are issues with games; in many participants destroy rather than create cultural context. Teamwork is often limited to strategic destruction, and most importantly, games do not change ways of thinking in relation to a culturally appropriate setting. Dramatically compelling games only have one meta-narrative, and are teleological; they tend to go forwards rather than backwards in time. This creates an interactivity problem. In virtual heritage applications the user will develop more ability to handle control and interact with information as time increases. Yet if the environment goes forwards in time more is known and hence there is less historically accurate interaction possible.

**Interactive Engagement-Orientated Mechanisms**

In order to evoke a sense of ‘dynamic place’ the virtual environment can be permanently modified by user interactions, and parts of that environment may impede the progress of the user in order for the user to recognise trails and paths, and socially accepted ways of traveling through the environment.

In a game the primary goal is to survive adversity by defending or attacking, but often there is a secondary goal of working out contextually situated puzzles, and acquiring artifacts to solve tasks. It may be instructive to users if they can collect and trade artifacts in order to improve their social role (‘Interactive Task-Oriented Artifacts’). Some artifacts could act as portals to previous times or to related environments. By relating the use of artifacts to tasks and to setting, the user may better understand the original cultural significance of the object.
Computer-scripted agents (‘Avatars’) that users can talk to, gain information from, and that remember them, will give the user information on where artifacts are, and how where and when the artifacts can be used.

Disorientation in virtual environments is an issue noted by several writers. Others mention the necessity of cognitive mapping for infrequent visitors to a site also known as ‘mental models’ [11]. Any device for orientation will help users navigate through an environment but a map further allows a graphical history of their virtual travels [12]. Maps can orient, help navigate, and recollect past episodes along a journey. Users may be allowed to select scale and position thumbnail icons of events, encounters, or artifacts onto their map (here known as a ‘Memento Map’).

Feedback Mechanism

Feedback usually measures effectiveness (how well the user achieves the goals they set out to achieve using the system), efficiency (the resources consumed in order to achieve their goals), and satisfaction (how the user feels about their use of the system). Using interactive mechanisms we might be able to assess effectiveness by the points or collected artifacts gained or lost by users in their attempt to solve tasks of navigation or dexterity.

A record of options selected by users may indicate user preference. The extent to which a map is uncovered or proximity triggers next to items of information may indicate preferred navigation. Chatlogs of dialogues with avatars linked to artificial intelligence databases may indicate how effective users are in eliciting information from the ‘chat-bots’. Artifact selection may indicate user knowledge of what is appropriate. The speed by which tasks are solved may also help indicate user satisfaction.
**Current Research Project**

The purpose of this research is to see if we can identify these interactive elements, in relation to audience purpose, and domain knowledge. The method proposed is in a sense, quite new to typical presence research in virtual environments. Such experiments are typically lab-based questionnaires asking whether people feel immersed in a virtual environment and to rank which features made them feel in another place, on a ranking of 1-5 or 1-7 on a Likert Scale. In this project, user interaction is stored and evaluated against questionnaires to determine the most preferred interactive features, and to see whether indirect evaluation may give accurate results as to user satisfaction and task performance. Such results (using memento maps, dynamic environments, task-related artifacts, and traveler-agent dialogue) may help us determine which features add most to engagement in a virtual tourism environment and to a ‘sense of place’.

**Test Audience**

The typical test audience may be PC-literate but not know either the chosen site or have extensive 3D environment experience (either through CAD or through gaming). Hence it may be useful to evaluate three types of users, CAD designers (who will have experience with 3D environments), archaeology students, and members of the general public who primarily enjoy traveling (say a Lonely Planet audience). They will be adult, PC-application literate, English-speaking and have no extensive site knowledge or knowledge of the culture of the modeled environment.
Software has been tested and two products chosen for the experiment, Adobe Atmosphere for the first evaluation, and Quest3D for the second. Atmosphere allows for chat-enabled internet-based three-dimensional worlds. Via JavaScript and XML files Atmosphere can import CAD-generated files, and incorporate Flash-based textures, Windows Media (streaming media), and dynamic scripted effects such as collision, a physics engine, position-based sound, database integration, particles, and key-events, chat-driven and button-driven interaction. It can also create its own native primitives for increased speed and improved dynamic lighting.

Various projects have already used Atmosphere for virtual archaeology projects (Stonehenge, lighthouse of Alexander, Landskrona Cathedral, the Great Pyramid of Cairo, Tikal, Tenochtitlan etc). However most have been as a three-dimensional gallery and not used advanced scripting techniques for increased interaction between artifacts, avatars and the environment.

Quest3D is a more sophisticated visualisation package aimed especially at architectural visualisation. The recent release includes a sophisticated artificial intelligence based path-finding system, optimized rendering for large crowds and for vast amounts of vegetation, real-time shadows, and ActiveX based webpage creation with JavaScript interactivity.
Mayan culture has been selected for its unique cultural beliefs (such as prayer based on bloodletting, ballgame-creation myth, extensive trade, deliberate cranial deformation and cross-eyed training, as well as a belief in communication between rulers and ancestors via “sky-snakes”).

Buildings were of extreme importance to the Mayans, they were living sources of energy, and offerings to them appeased the gods, necessary for the primary crop, maize to grow. Buildings were layered in order to augment their ‘spirit energy’ and each of the four directions required specific offerings. They were memory palaces that were kept perfectly preserved for hundreds of years. New layers of buildings were built on top of older ones, as the Mayans attempted to augment the sacred ‘energy’ of the ancestors to whom the buildings commemorated. Each of the four directions had special significance, as did the cenotes, the extremely deep wells to which the Mayans threw offerings, and which were sacred paths to the underworld and to hell.

Of a different physical scale to many modern people, the Mayans did not have the use of the wheel the arch or the horse. Yet they had an extensive knowledge of astronomy, intricate calendar systems, and a highly developed glyphic language (sculptures, paintings and books). Today there are millions of Mayans who still speak the ancestral language but cannot read it. Their traditions have been infused to some extent with that of the Spanish, and all but a few of their books have been burnt. Yet even today many still follow the dedication of offerings to buildings and follow the ancient ceremony ‘Day of the Dead’.

Figure 1: The Palace, Palenque, Mexico using CAD models imported into Atmosphere

Test Environment

Mayan culture has been selected for its unique cultural beliefs (such as prayer based on bloodletting, ballgame-creation myth, extensive trade, deliberate cranial deformation and cross-eyed training, as well as a belief in communication between rulers and ancestors via “sky-snakes”).

Buildings were of extreme importance to the Mayans, they were living sources of energy, and offerings to them appeased the gods, necessary for the primary crop, maize to grow. Buildings were layered in order to augment their ‘spirit energy’ and each of the four directions required specific offerings. They were memory palaces that were kept perfectly preserved for hundreds of years. New layers of buildings were built on top of older ones, as the Mayans attempted to augment the sacred ‘energy’ of the ancestors to whom the buildings commemorated. Each of the four directions had special significance, as did the cenotes, the extremely deep wells to which the Mayans threw offerings, and which were sacred paths to the underworld and to hell.

Of a different physical scale to many modern people, the Mayans did not have the use of the wheel the arch or the horse. Yet they had an extensive knowledge of astronomy, intricate calendar systems, and a highly developed glyphic language (sculptures, paintings and books). Today there are millions of Mayans who still speak the ancestral language but cannot read it. Their traditions have been infused to some extent with that of the Spanish, and all but a few of their books have been burnt. Yet even today many still follow the dedication of offerings to buildings and follow the ancient ceremony ‘Day of the Dead’.
I am currently modeling a 600-800 AD, Mayan site in Mexico, called Palenque. Mentioned in the Popol Vuh, Palenque is a majestic mist-covered site, which is well documented, well mapped and understood. A burial place of important rulers with still extant aqueducts, it is less visited than other major Mayan sites yet three of its major temples recreate the Mayan story of creation.

The experiment involves three ‘World-Modes’ each offering different ways of experiencing Palenque over several hundred years. Taking twenty minutes to complete each world-mode, the three groups are required to browse, question, and trade. Scores will be kept and compared to questionnaires as to which goals and types of features were found to be most engaging. The three world-modes are:

1. BROWSING: Explore everything using on-click or proximity-based triggers. Half of the time the environment will be dynamic (wind and rain and collision may impede the user). Half the group will have the option of using interactive maps which will indicate where they have been.

2. QUESTIONING: The goal is to talk to inhabitant avatars, which will be archaeologists or resident rulers. Half the time the inhabitants are just automatic guides, the other half of the time they can converse with and remember the users. Fog will indicate chronology.

3. TRADING: The goal is to collect artifacts and avoid others. Half the time the others will be resident avatars with simple path-finding ability, the other half of the time the avatars will be other users. Status bars and daylighting will indicate changes in progress and in time.

Conclusion:
The results from this research will hopefully indicate whether ‘Virtual Travel’ can help the understanding of another inhabited place using 3 modes of interaction (browsing, questioning, trading), which mode is most interesting?, which affordances and constraints work best, and whether personalization is essential to engagement? Do the results vary according to audience?

References


