Cultural Engagement in Virtual Heritage Environments with Inbuilt Interactive Evaluation Mechanisms

Erik Champion, University of Melbourne

Abstract

My initial premise is that virtual heritage environments currently do not provide a sense of 'cultural' engagement, and, secondly, that is it important to fulfill these needs. Indeed, how can we develop virtual environments for cultural applications that successfully evoke a sense of engagement or immersion?

This paper suggests that the above issue has been indirectly addressed by entertainment software design. A proposed solution to the issue of cultural presence is thus to apply the interactive mechanisms used in games (social agents, maps, dynamic environments, levels of interaction constraint, and task-based artefactual use) to virtual heritage environments. The hypothesis is that the resulting environment will allow for a more culturally immersive learning environment.

Virtual environments also often lack adequate feedback mechanisms. A proposed secondary solution is that designers and researchers of virtual environment can use the above interactive mechanisms for the evaluation of user engagement without simultaneously interrupting the user's feeling of engagement.

Virtual Heritage

Virtual Environments Lack Meaningful Content

Many critics have argued that virtual environments have had a large number of issues blocking widespread dissemination, distribution, and use. Some issues cited include a lack of engagement and of presence (as in, a feeling of "being there," of being transported to an actual place).

Technical issues include slowness, and a lack of realism. Other criticisms of virtual environments have pointed to a lack of meaningful content, confusing interface design, orientation and navigation difficulties, and a paucity of useful feedback mechanisms (Costalli et al, 2001, Campbell, 1997, Economou, 2000).

Virtual environments are often criticized for evoking 'cyberspace' but not 'place'.In other words they lack the richness of associations and encounters of meetings in real space. Refer Kitchin (1998), Benedikt (1991), Johnson (1997), Heim (1997) and Coyne (1997, 1999).

Virtual Heritage Environments Lack Cultural Presence

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 to preserve the culturally signficant articles of the past, they must demonstrate the reasons for simulating that past material culture. Yet they are generally used as showcases for technology rather than for edification.

For example, a major portal for virtual heritage, www.virtualheritage.net, records the most popular articles, not the most popular models. Virtual heritage models are still not considered worthy intellectual content even by societies dedicated to their advancement. Major conservation organizations do not know of the potential of virtual environments to preserve both the formal specifications of the objects, and their cultural associations.

The ICOMOS Burra Charter does not list digital media as one of the many listed media to record cultural heritage, (ICOMOS Burra Charter Guidelines: Cultural Significance 1998- a revised edition was promised to appear in 1999). Surely, if ICOMOS thought cultural heritage was accurately recorded digitally, they would list it as one of the media. Yet, with current advances in scanning and related technology, realistic capture does not seem to be an insurmountable problem.

I suggest virtual heritage environments lack meaningful content necessary for a sense of cultural presence, as there appears to the relevant bodies no reason to value 3d models of accuracy over traditional means of evaluating or experiencing heritage objects. Virtual heritage environments do not convey the context, the cultural setting.

This may be due to the difficulty of conveying the worth of objects from a different cultural background, of conveying its cultural signicance, its imagined presence. This idea of cultural presence is my term for a feeling in a virtual environment that people with a different cultural perspective occupy a place. Some researchers have even defined presence as being in a place that has some present meaning to the viewer (Slater, 1999).

True, it is almost certainly far more difficult to evoke this sense of presence of being transported to a "there" that feels different, as compared to evoking the conventional meaning of presence (merely feeling that one is "there").

Yet difficulty does not logically necessitate impossibility. In order to evoke a sense of cultural presence we need to understand how cultural cues are created and identified.

Researchers such as Schank, (1990), and Miller (1999), believe we learn about a culture through dynamically participating in the interactions between

- Cultural setting (a place that indicates certain types of social behavior)
- Artifacts (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* your own personal motives.

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 to occur.

Schiffer and Miller argues 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", (Schiffer and Miller 1998, 5). 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.

For Dorothy Massey, place may have any of the following features: a record of social processes; fluid boundaries; and internal conflicts. A place is evocative and often fluid, and full of mementos from other places. To view a place as a container of x y and z dimensions is to deny it a cultural content. A place is more like a nexus, or a web [Massey, 1997]. The question then is, how do we gain such a sense of place via virtual environments?

We can argue that for creating 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 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.

This virtual place must suggest ideas of thematically related events, evidence of social autonomoy, 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).

"If during the VE 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."[Slater, 1999]. Are we replacing a vague notion of presence with a vague notion of place?

Cultural Presence

Some researchers have defined presence as being in a place that has some present meaning to the viewer (Slater, 1999). I suggest virtual heritage environments lack meaningful content necessary for a sense of cultural presence, as there appears to the relevant bodies no reason to value 3d models of accuracy over traditional means of evaluating or experiencing heritage objects. Virtual heritage environments do not convey the context, the cultural setting.

This may be due to the difficulty of conveying the worth of objects from a different cultural background, of conveying its cultural significance, its imagined presence. 'Cultural presence' is my term for a feeling in a virtual environment that people with a different cultural perspective occupy or have occupied that virtual environment as a 'place'.

True, it is almost certainly far more difficult to evoke this sense of presence of being transported to a "there" that feels different, as compared to evoking the conventional meaning of presence (merely feeling that one is "there"). Yet difficulty does not logically necessitate impossibility. In order to evoke a sense of cultural presence we need to understand how cultural cues are created and identified.

Researchers such as Schank (1990), and Miller (1999), believe we learn about a culture through dynamically participating in the interactions between setting, object, and audience. That is, cultural setting (a place that indicates certain types of social behavior), artefacts (and how they are used), and people teaching us a social background and how to behave. We learn such behaviour and context through dialogue devices such as stories and commands *along with* our own personal motives.

A culturally constraining environment with task-related artefacts as used by social agents is missing from the majority of virtual heritage environments. Social presence is a powerful

mechanism for creating a sense of engagement. However, without artefacts and a shared understanding of tasks, the presence of others only allows social behavior to occur.

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 artefacts will be more difficult to learn. The process of cultural dissemination requires a notion of place.

Place

We can argue that for creating 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 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 'other' inhabitants. Hence cultural presence is not just a feeling of 'being there' but of being in a 'there and then' that is not following the cultural rules of the 'here and now'.

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

Kalay and Marx propose eight criteria for "Cyber-Placemaking" (Kalay and Marx, 2001) borrowed from architecture and town planning. These include: as settings for events, that are engaging, provide relative location (i.e. orientation), provide authenticity, are adaptable, afford a variety of experiences, afford choice and control over transitions, and are inherently memorable.

Relph notes: "The identity of a place is comprised of three interrelated components, each irreducible to the other, physical features or appearance, observable activities and functions, and meanings or symbols." So the place-making criteria of Kalay and Marx address only two major types of environments addressed by Relph, environments that afford 'physical features or appearances', and those that afford 'activities'. The Kalay-Marx criteria, being based on modes of reality, do not address virtual environments that attempt to offer interpretations of past and present cultures.

Partly this omission is due to the fact that it is difficult to simulate culture. As Yi-Fuan Tuan notes (1998), "Seeing what is not there lies at the foundation of all human culture." The only way then to approach this issue is to view (and design) environments depicting human cultures to be hermeneutic (that afford an actively engaged interpretation of the lives and intentions of past inhabitants). The hermeneutic features of place in these environments are almost certainly more difficult to create digitally, but that does not negate their importance. Luckily for virtual environment designers, these hermeneutic features have been described by social scientists.

For cultural geographers, culture has a setting and this setting is enabled through a perceived sense of place. As culture requires a setting, it must be "embedded in real-life situations, in temporally and spatially specific ways" (Crang 1988). While unique, place is further an "integration of elements of nature and culture…linked to other places by circulation" (Lukermann cited in Relph 1986).

The interactions between these objects and their setting may be quite complex (Cantor 1976). Culture is a feedback loop. A visitor perceives space as place, and inhabits (modifies the place), place "perpetuates culture" and thus influences the inhabitants in turn.

We might say that social behavior is behavior between two or more people. Cultural behavior is a subset of social behavior, where behavior is governed by or understood in terms of a cultural setting. And as culture almost inevitably involves transactions, there must be objects of shared transactional value. Hence, to convey cultural knowledge, we have to represent processes, which requires interactivity.

Designers of real and virtual environments need to build on relationship between patterns of inhabitation and usage of spatial artifacts, such as furnishings, (Rapoport 1982; Beckmann 1998). Even if the word 'culture' is a noun and not a verb, cultures are processes not products. Cultures can only exist socially through artifacts, labeled by Sauer as "agents of change" (Crang 1998). However, artifacts alone constitute only a fragment of the cultural process. To fully understand a cultural environment, one requires both artifacts, and an idea of the task that motivates using them.

Thus, the old communication model of culture requiring only a sender and receiver of data is inadequate; culture is a highly interactive dialogue of human ideas transmitted via social and individually constructed places. In order to create culturally evocative environments, we need to understand which interactive elements disseminate cultural information. According to Schank (1990), and Schiffer and Miller (1999), we learn about a culture through dynamically participating in the interactions between

- Cultural setting (a place that indicates certain types of social behavior).

- Artifacts (and how they are used).

- And people teaching others a social background and how to behave *along with* one's personal motives.

Table 1: Graduation of Place and Cultural Functions

Type of VE	Relph's categories	Features	Personal / Cultural Attachment
Spatial Visualization	Existential outsideness- (Objective)	Locational (links)	Locates setting
		Navigational (orients)	Locates paths and centres
Activity-based	Vicarious-behavioral-empathetic insideness (Activity and Events)	Memorable (unique)	Has uniquely occurring events
		Territorial (protects)	Locates shelter; repose in regards to dynamic environment
		Modifiable	The artifacts and surrounds can be modified
Hermeneutic	Existential insideness (Symbolic)	Culturally coded	Supports an idea of agency-directed symbols that reveal secrets of the environment
		Abandoned inhabitation	Evokes an idea of social agency and past inhabitation
		Lived-in inhabitation	Supports interpersonal social behavior through human and or computer agents
		Home	Affords personal shelter, primary orientation, identification, possession and collection of artifacts.

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 thus NOT a problem with capturing realism. Virtual environments exist with photo-realistic laser-scanned artefacts, augmented by textures scanned in from real-world materials. Therefore virtual heritage environments may lack a sense of engagement not so much through a lack of photo-realism, but because they lack the interactive elements that have made computer games so popular.

Learning Interactive Techniques via Game Design

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 (Bryce & Rutter, 2001). Entertainment software is the fastest growing of all types of entertainment, outselling films. Today's game consoles also rival supercomputers of a decade or more, (Laird, 2001). Games are designed for interactive engagement, and are arguably the most popular and widespread form of virtual environments. So it seems that interactive engagement are the two most desirable features of virtual environments to the general public.

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. As in games, virtual environment users may prefer personalization, (Hein, 1991). Further, as the most popular games (excluding Tetris), requires representations of opponents (social agents), so too do virtual environments.

Game designers engage and hold the attention of the user via interactive features (such as the provision of maps, dynamic features of the environment, social agency, and task-directed artefacts). Furthermore, games cater to learning curves of new users by advancing in complexity over time, they can also be personalised and typically have a built-in assessment of task performance. However games are often destructive rather than constructive, and destroy rather than create other cultural context. In other words, games do not generally change ways of thinking in relation to a culturally appropriate setting.

Interactive Elements

The below list in the scenario section is of interactive features common to games that I suggest using in virtual heritage environments.

Dynamic Place

Create changing factors in dynamic environments that have an effect on how people move through virtual environments. Paths, changing light and obstacles will aid or impede navigation. Less skillful navigation will adversely affect metaphorical 'health points' (as borrowed from game design). The dangers and opportunities of the environment will be contextually related to the local cultural perspective.

Interactive Task-Oriented Artefacts

In the proposed scenario participants will collect and trade artefacts in order to improve the participant's social role. Some artefacts will act as portals to previous times. By relating the use of artefacts to tasks and to setting, it is hoped that the user will understand the original cultural significance of the object.

Travelers can view the effects of how they choose to complete tasks via the artefacts at their disposal and record the rate of completion of tasks. Further, artefact selection indicates knowledge (allow a maximum of artefacts to be carried by the user).

Avatars

Computer-scripted agents that users can talk to, gain information from, and that remember them, will give the user information on where artefacts are, and how they cam be utilised.

Scripted agents will act as dialogue aids - agent-traveler dialogue - to help travelers via appropriately worded questions. The speed and accuracy with which users learn how to talk to the phrase limited agents suggests engagement.

Memento Maps

Disorientation is an issue noted by several writers [Darken, 1995]. Others mention that for infrequent visitors to a site, help in establishing cognitive mapping is required (Modjeska, 1997).

For orientation and to keep mementos relating to special events, participants can select, scale, and position thumbnail icons of events, encounters, or artefacts onto their map (here known as a 'memento map').

As users progress through the virtual environment, the map improves in local accuracy. Any device for orientation will help users navigate through an environment but a map further allows a graphical history of their virtual travels, (see especially Ramloll and Mowat, 2001).

Users can update the memento maps with their own sized positioned and scaled thumbnail icons. These icons when clicked on will hyperlink to the time and location of the event encounter or landmark recorded. The frequency, accuracy and sizing of icons will indicate their amount of care and concern with the landmarks.

Proposed Evaluation

How do we evaluate user satisfaction? For computer games it is easy- successful ones are bought by people who personalise artefacts in the game and make worlds (often called levels or maps) to add to it. The most popular games involve worldwide online competitions to combat others. Highly detailed online fan forums also support major games. In short, games are generally reviewed and critiqued by how engaging they are.

Academic virtual environment evaluation usually involves requesting test users to fill out questionnaires indicating a level of presence against 3, 4 or 5 general criteria (a feeling of physical space, negative feelings, social agency, naturalism or realism, and engagement).

For example, Professor Mel Slater uses questionnaires although he does not want to, and the best time to ask people to measure a sense of presence is the worst time as well.

To check engagement we need evaluation devices but we cannot stop people who are in a virtual environment to evaluate their feelings of engagement as that will affect their sense of engagement. Further, on evaluating people after their experience of the virtual environment may be prone to error, as it relies on memory recall and on their noticing and communicating exactly what made their sense of engagement seem powerful or weak or non-existent.

If a virtual environment seems 'natural' to viewers, they may not notice important features that a trained expert would consider distracting or ineffective. We need 'passive' evaluation mechanisms to determine the level and type of engagement without breaking that level of engagement. For example, in games, data is gathered by innate interactive mechanisms (chat logs, health points, completion of the memento map, and the final state of the inventory of artefacts). Such data could be compared against results from a pre and post-experience user evaluation questionnaire to determine if we can can gain user feedback on cultural immersion in virtual heritage environments without their enjoyment being curtailed, and without them begin forced to participate in laboratory interviews or complete survey forms.

Evaluation Project

The following project is designed to address problems of interacting with a time-based cultural setting in order to resolve which features add to a hermeneutic feeling of place.

| Stages of features (with volume control)	Explore Site	Learn social roles through speaking to Avatars	Share maps and artifacts with other users
Footsteps	Yes	Yes	Yes
Noise	Yes	Yes	Yes
View of own avatar	Yes	Yes	Yes
View of own avatar in contextual costume	Yes	Yes	Yes
Inventory	Yes	Yes	Yes
Directional/Disembodied Voices	Yes	Yes	Yes
Hieroglyphs with event-based sound	Yes	Yes	Yes
Avatars with chat	Yes	Yes	Yes
Avatars with spoken chat	Yes	Yes	Yes
Avatars with spoken chat and recall	Yes	Yes	Yes
Ability to see avatars of other users	Yes	No	Yes
Performance Evaluation	Inventory. Record icons on map.	Record dialogue, check content and user recall	Inventory. Gain all artifacts and locate on map

Users will enter each enter one of three different virtual reconstructions of an archaeological site, Palenque, a Classical Mayan site in Mexico. The first group has to merely explore the site in time and space, and click on objects to travel back in time. The goal will be to reach all parts of the site (which will automatically 'fill in' the related memento map).

The second environment will have the same modeled world along with hyperlinked interactive panoramas and avatars that can ask and remember simple dialogue. The task will be to gain knowledge through questioning the avatars.

The third environment will have the same modeled buildings as well as collectable artefacts that are required to navigate through the site, (in time and space-Mayan artefacts were considered portals to spiritual sites) by solving culturally specific problems. The objective will be to collect and trade with other users the most powerful artefacts (the artefacts will have a ranking in terms of social prestige, and participants can only carry a certain number of

artefacts) in order to change the social role. Certain artifacts will also act as constraints, slow down or obscure progress etc.

Presentation of Expected Findings
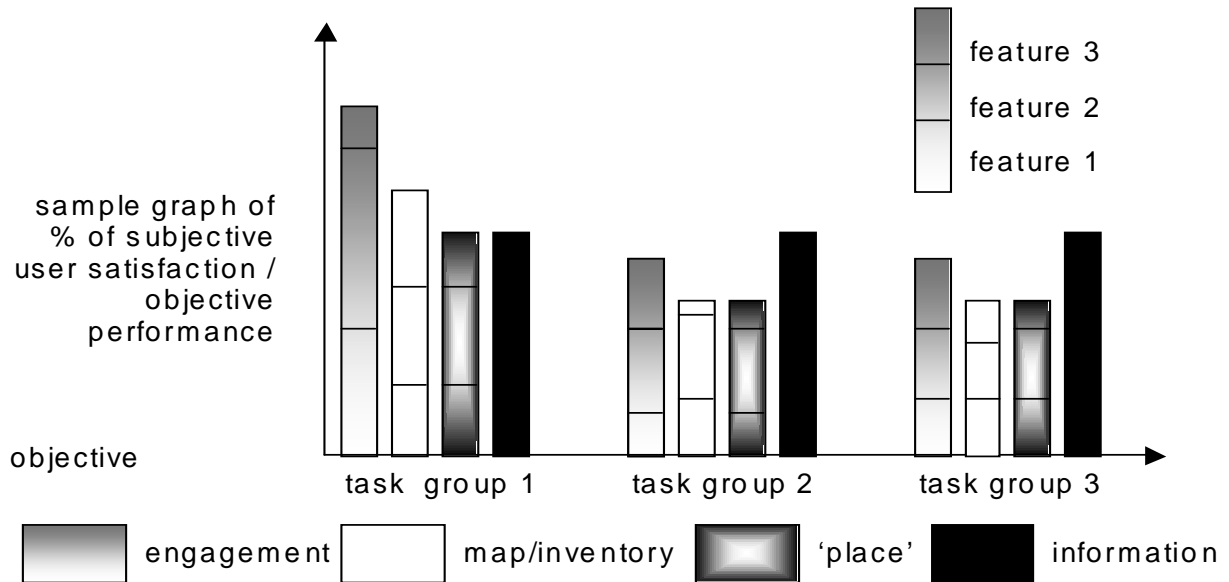
Conclusion

The data gathered from user evaluations will hopefully suggest answers to the following questions. Which varying modes of interactivity (constraints and affordances) add most to engagement in a virtual tourism environment and to a 'sense of place'? Which tasks are msot popular? Is this indicated by the data collected by the interactive elements themselves or by the questionnaire?

Is it possible for wide segments of an audience to be engaged and educated at the same time by interactions in a virtual archaeology project? Or must we leave genuine engagement to the realm of games?

 Finally, did travelers most enjoy collecting artefacts, questioning avatars or trading with their fellow avatars, and did this allow them to gain a culturally embedded new world-view?[1]

---

[1] Another possible affordance-constraint-task situation would be using dynamic environmental features, such as battling the elements to reach remote parts of the site. For this experiment, such a model has been deferred, as it is less likely to directly enhance cultural immersion.

Acknowledgements

References

Benedikt, M. ed. (1991). *Cyberspace: first steps*. Cambridge, MA: MIT Press.

Bryce, J., & Rutter, J. (2001). Presence in Public Computer Gaming, Dept of Psychology, University of Central Lancashire & Centre for Research on Innovation & Competition (CRIC), University of Manchester, 2001 presented at "Computer Games & Digital Textualities", IT University of Copenhagen, March 2001. Digiplay Initiative http://www.digiplay.org.uk/Game.php.

Campbell, D.A (1997). Explorations into virtual architecture: a HIT Lab gallery . *In IEEE Multimedia,* Volume: 4 Issue: 1, Jan.-March Page(s): 74 –76

Costalli, F., Marucci, L., Mori, G., and Paterno, F. (2001). Design Criteria For Usable Web-Accessible Virtual Environments. *Proceedings of the* iCHIM2001 conference.

Coyne, R. (1999). Technoromanticism: Digital Narrative, Holism, and the Romance of the Real. Cambridge Massachusetts USA: The MIT Press

Darken, R. (1995). Wayfinding in Large-Scale Virtual Worlds http://www.seas.gwu.edu/~sibert/darken/publications/Dissertation_95/thesis.html

Economou, D. (2000). Vlearn3d, 2000 Conference in Cornwall. Web transcript Presenters: Andrew Phelps from Rochester Institute of Technology and Daphne Economou from Manchester Metropolitan University, UK http://www.vlearn3d.org/conference/panelone.html last read November 5, 2001.

Greeff, M., and Lalioti, V (2001). Interactive Cultural Experiences using Virtual Identities. *Proceedings of the* iCHIM2001 conference.

Heim, M. (1998). Creating the Virtual Middle Ground. In *TECHNOS Quarterly For Education and Technology* 7(3).

Hein, G. E. (1991). The Museum and the Needs of People CECA (International Committee of Museum Educators) Conference Jerusalem Israel, 15-22 October 1991 Lesley College. Massachusetts USA Constructivism http://www.exploratorium.edu/IFI/resources/constructivistlearning.html [© 1996 Exploratorium, 3601 Lyon St., San Francisco, CA 94123]

ICOMOS Burra Charter Guidelines: Cultural Significance (1998). (http://www.icomos.org/australia/burrasig.html)

Johnson, G. (1991). In the Palaces of Memory: How we build the worlds inside our heads. Vintage Books NY.

Johnson, S. (1997). Interface Culture: How New Technology Transforms the Way We think and communicate. San Francisco: HarperEdge.

Kalay, Y. and J. Marx. (2001). Architecture and the Internet: Designing Places in Cyberspace. In *Proceedings of ACADIA 2001: Reinventing the Discourse*, ed. W. Jabi. 230-240.

Laird, J. E. (2001). Using Computer Game to Develop Advanced AI IN Computer, 34 (7), July 2001, pp. 70-75.

Laird, J. E., van Lent, M. (2000). *Human-level AI's Killer Application: Interactive Computer Games*. Talk, AAAI.

Laurel, B., ed. (1990). *The Art of Human-Computer Interface Design*. New York: Addison-Wesley.

Laurel, B., Strickland, R., Tow, R., (1994). Placeholder: Landscape and Narrative In Virtual Environments In *ACM Computer Graphics Quarterly* Volume 28 Number 2 May

Massey, D. (1993). A Global Sense of Place. In *Marxism Today* re-printed in *Studying culture: an introductory reader*, eds. A. Gray and J. McGuigan. London; New York: E. Arnold.

Miller, D., ed. (1988). *Material Cultures, Why Some Things Matter*. London: UCL Press.

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

Ramloll, R., Mowat, D. (2001). Wayfinding in Virtual Environments Using an Interactive Spatial Cognitive Map. *IV2001 Proceedings* (London), IEEE Press. 2001. http://www.dcs.gla.ac.uk/~ramesh/Online%20Publication/ramlollr_wayfinding.pdf.

Relph, E. C. (1986). Place and Placelessness. London: Pion Ltd.

Schank, R. C. (1990). Tell me a story: a new look at real and artificial memory, Published New York : Scribner.

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

Schroeder, R. (1996). *Possible worlds: the social dynamic of virtual reality technology*. Boulder, Colo.: Westview Press.

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

Schuemie, M. J., van der Straatten, P., Krijn, M., and C.P.G. van der Mast. (2001). Research on Presence in VR: A Survey. In *Cyberpsychology and Behavior* Delft.

Slater, M. (1999). Measuring Presence: A Response to the Witmer and Singer Presence Questionnaire. In *Presence*, vol.8, no.5, pp 560-565. http://citeseer.nj.nec.com/slater99measuring.html Viewed October 25, 2001.

Tuan, Y. (1998). *Escapism*. Baltimore: John Hopkins University Press.

Woolley, B. (1992). Virtual Worlds: A Journey in Hype and Hyperreality. Oxford: Blackwell.