

Designing Information, Experience and Presence: An Interdisciplinary Approach to Virtual Heritage

Alison de Kruiff, Swinburne University of Technology

Carolyn Barnes, Swinburne University of Technology

Abstract

Digitisation, combined with the Internet, offers new access to heritage sites. However, overcoming the intrusion of the mediating technology to give people a feeling of 'being there' — a psychological phenomenon known as presence — is a fundamental challenge in developing Web-based virtual heritage environments. Design is important to the communication of presence, but its role is not considered in the literatures of virtual heritage or presence. In crossing matters of form, content, people and technology, issues in virtual heritage resist the processes of reduction that characterise traditional disciplinary research. This paper combines ideas from information and experience design, presence and virtual heritage to investigate how the demand for historical accuracy and heightened audience experience can be balanced in creating virtual heritage environments. Conversely, it also discusses the risks for design researchers in drawing on heterogeneous sources of knowledge, but argues that this is a way to see larger issues in design.

Keywords: *virtual heritage, presence, phenomenology, information design, experience design, interdisciplinarity, practice-based research.*

Introduction

The Western scholarly tradition has supported interdisciplinarity since the time of the Greek Sophists, when the idea of the well-rounded education exposed students to all existing disciplines in turn. In modernity, however, the disciplines progressively became more separate and specialised (Latour, 1991), Lyotard (1984) depicting the rise of modernist empiricism as prompting 'a multiplication of argumentation and a rising complexity level in the process of establishing proof (p. 41)'. Recent interest in interdisciplinarity seeks to redress the problems caused by specialisation. For Gusdorf (1977), 'As specialization has brought about the advancement of learning, so the concern for unity has fostered a desire for a bringing together again, a reamalgamation to remedy the intolerable fragmentation both in the fields of knowledge and in the men of science (p. 581)'. Aside from the idealism of reunifying fragmented spheres of knowledge, there are pragmatic reasons for

interdisciplinary research. Ideas and methods from one discipline can aid the identification, understanding and solution of problems in another (Aram, 2004, p. 382). Sourcing knowledge and methods from other disciplines is sometimes the only means of progress in research, Bruhn (2000) arguing that interdisciplinary research has proved its value 'when traditional research approaches have failed to come up with answers to common problems (p. 58)'. Interdisciplinary research is almost inevitable in design, design research questions typically emerging from a combination of human, economic and technological factors.

Even so, research conducted between disciplines raises basic questions about the nature of the relationship between bodies of knowledge and methods, namely whether the research is multidisciplinary, interdisciplinary or transdisciplinary. Each category of research crosses disciplinary boundaries, but through a different order of exchange. Choi and Pak (2006) argue that multidisciplinary research happens without a merging of disciplinary boundaries, problems being worked on sequentially or in parallel. Interdisciplinary research is interactive, blurring the boundaries between disciplines to create 'new common methodologies, perspectives, knowledge, or even new disciplines, where transdisciplinary research views complete systems in a holistic manner (Choi & Pak, 2006, p. 359)'. Aram (2004) writes of 'instrumental interdisciplinarity', which seeks to build bridges between fields in the search for answers, 'epistemological interdisciplinarity', where other disciplinary knowledge redefines a field of thought and transdisciplinarity, which seeks 'coherence, unity and simplicity of knowledge' (p. 382). For Thompson Klein (2004, p. 515), transdisciplinary research produces general concepts that drive a range of disciplines and is reflected in the rise of transcendent intellectual paradigms such as Marxism or feminism, or fields like cultural studies that exceed one discipline, or general studies such as philosophy or religious studies that exist concurrently over a broad fields of scholarship.

Design research is already conducted in a range of disciplines. The synthesis of different disciplinary knowledge has brought new ideas and methods to understanding design. However, in traversing disciplinary boundaries, design researchers risk appropriating knowledge without understanding the full meaning of the borrowed ideas. Before a researcher can apply new ideas or methods in their home discipline, they need to understand their meaning in their original disciplinary context (Lauer, 1984), otherwise the exploration of research questions may be superficial rather than deep. Indeed, Durling (2002, p. 82) cautions that where a researcher's limitations and personal interests frame the combination of knowledge in design research rather than specific research problems or questions, the resultant study may be a loose collection of methods and ideas. Golde and Gallagher (1999) warn that research conducted in the gap between different fields means the researcher has no established frameworks or models to guide them.

'Knowledge' in a substantially vocational field such as design is mostly practice-driven not evidence-based and there is heated debate about the role of practice in design research (Friedman, 2003; Downton, 2003; Candlin, 2000; Pedgley & Wormwald, 2007; Pedgley 2007). However, Samraj and Swales (2000, p.52) argue that where a contextual problem frames multidisciplinary research, the application of theory to practice may result in the successful synthesis of disciplinary perspectives and ensure the relevance of any new knowledge produced. This paper reports on research that used a real world project from the area of virtual heritage to investigate the design of affective information, highlighting the convergence of the fields of information and experience design. In exploring how to balance audience experience and historical accuracy in the development of a virtual heritage environment, the research incorporated ideas and evidence from the fields of information and experience design, presence and virtual heritage. Our paper shows that where a design project contextualises a research investigation, providing the source and justification for its questions, real world factors can have a positive effect in defining the ambit and validity of a research investigation.

1. Design research, interdisciplinary by nature?

Design research is inherently interdisciplinary in seeking to understand important aspects of the human world. Cross (1999) cites Simon's argument that, 'The proper study of mankind is the science of design (pp. 7-8)'. Simon argues that since design is intrinsic to the production of the artificial world, the investigation of design automatically crosses into other knowledge areas and can also provide the overarching impetus for communication between creative fields as disparate as engineering and music. Design may be a transcendent area of human activity fundamental to the production of the artificial world, but this does not answer the problem of how design researchers can negotiate interdisciplinary knowledge. A basic struggle exists between disciplinarity and interdisciplinarity in design research. Cross accepts there is growing recognition of design as a rightful academic discipline and increasing awareness of the applicability and strengths of design thinking within the context of design research; this builds the argument for an independent design research culture, but the role of design practice in design research remains vexed for the design research community, being bound up in questions of rigour.

Downton (2003) argues that the activity-based nature of design validates the idea of designing as research. Others contend this does not stand up to the exacting needs of research (Friedman, 2003; Durling, 2002). Indeed, Archer expressly warns against designers becoming researchers, and vice versa, since the demands of the two fields are very different (see Pedgley & Wormwald, 2007, p. 71). Design practice alone is not generally regarded as a strong enough research method (Candlin, 2000; Pedgley & Wormwald, 2007; United Kingdom Council for Graduate Education, 1997), but design practice can form part of a valid research investigation if combined with other aspects of research such

as logical argument to enable hypotheses formation, theory building and to enable research dissemination. For Cross (1999), however, a line needs to be drawn between works of practice and works of research given that the purpose of research is ‘to extract reliable knowledge from either the natural or artificial world, and to make that knowledge available to others in re-usable form (p. 9)’.

Rigour is risked when other disciplinary knowledge is added to design research investigations. For Buchanan (2001), applied research allows the proposition of general theories and models from the conduct and reporting of individual cases. However, he recognises that the multitude of other factors that can enter the investigation of real world products or activities can compromise the scope for generalisation (Buchanan, 2001, p. 18). The requirement for theory building may not be possible in individual design research investigations, especially where applied research and interdisciplinarity are central to the study, the specificity of the real world problem perhaps proving resistant to the proposition of hypotheses. For, Cross (1999) the main challenge for design research is finding ‘a way of conversing about design that is ... both interdisciplinary and disciplined. We do not want conversations that fail to connect across disciplines, that fail to reach common understanding, and that fail to create new knowledge and perceptions of design. It is the paradoxical task of creating an interdisciplinary discipline (p. 8)’.

2. The applied project as a research question

In this research, the use of design to convey the feeling of presence in an online virtual heritage environment framed the research investigation. It set key research directions and influenced conceptual frameworks and methods and also identified important issues and questions for the fields of information and experience design, suggesting their convergence where presently they are largely separate fields of design practice and thinking. Virtual heritage is an increasingly important area within museums and cultural heritage, mixing sites and artefacts with information technology to provide new ways for people to access heritage information and experience. It is an emerging area of research, focused on issues associated with the digitisation, preservation and dissemination of information on cultural sites and objects. By its nature, virtual heritage is transdisciplinary, combining elements of archaeology, heritage studies, information technology and design among others. The applied project, a digital reconstruction of a temple complex, is an online companion to the exhibition ‘Ancient Hampi: The Hindu Kingdom Brought to Life’, Melbourne Immigration Museum (2008-2010). The Ancient Hampi exhibition sought to give the viewing audience an experience of being at the temple sites of Hampi, sparking their interest in the area and its rich cultural background, an objective heavily reliant on creating the psychological feeling known as ‘presence’.

One of the purposes of the Place-Hampi installation is to give the audience the feeling that they had been transported to India and are viewing the scene directly. This is done through journey, by 'virtually' moving from one viewing space to another, through interaction with the platform itself, giving agency to the person driving the experience, through stereoscopic visuals and sounds, and through interactive relationships with avatars representing the gods of the temples (Kenderdine, 2007). The accompanying website supplements the experience with contextual information and with additional multimedia content. A digital 3D reconstruction of the Vitthala temple was created to explore the design of presence in online media. Although a home computer cannot give the same experience as the installation piece at the Ancient Hampi exhibition, a computer screen being a far more restrictive viewing area than a 360 degree PLACE screen, it has the benefit of allowing the viewer to have an experience of Hampi from their own home. The challenge was to bring the feeling of 'being there' to the online environment.

Presence is a term used to describe the feeling of 'really being there' that arises when a person operating in a digital environment ignores the mediating technology of the experience and directly processes the visual, auditory and haptic stimuli. Biocca (1997) identifies presence as "the illusion of 'being there' whether or not 'there' exists in physical space (p. 18)." Within the research, the development of a digital reconstruction of the Vitthala Temple, situated near the village of Hampi in the Indian state of Karnataka, highlighted the challenges involved in achieving presence through design. The causes and effects of presence are widely debated, there being no agreed position in the broad literature on presence to account for its nature and thus no established criteria for recreating it. Different researchers conceptualise presence in different ways. Some describe it as the feeling of being there, the feeling of being in a mediated environment, a uni-dimensional experience, or something experienced on many different levels. Some even argue that presence research should not be limited to digitally mediated environments, but has an equal place in the consideration of human cognitive experience in physical environments. There is wide debate on the causes of presence; whether it is a perceptual failure, a perceptual illusion or a side-effect of immersion and involvement (Bracken, 2005, p. 192; Carassa, Morganti & Tirassa, 2005, p. 384). Many writers highlight that presence is also a highly subjective and variable experience (Bracken, 2005, p. 193; Herrera, Jordan & Vera, 2006, p. 548), Heeter (2003, p. 336) arguing that it depends on an individual's reception of sensory data in any instance and also on people's past experiences.

Contention over the characteristics and causes of presence is a matter for presence researchers to solve, not design research. Design research investigates matters of design, the inherent emphasis in this research being the challenge theories of presence offer to existing design practices and their understanding. In this research, the diverse theories within presence research are not weighed against one another, but rather applied on the basis of their relevance to design. The research approaches

presence as a design issue after establishing common axioms and theoretical connections between presence research and design research. The way forward resides in how people process information, building on connections between phenomenology, presence, interpretive archaeology and information design to create new frameworks for the design of virtual heritage environments.

Floridi (2005) sees presence as an epistemic failure that creates a false psychological impression. Rather than seeing presence as a psychological mistake, the research addressed it as a feeling that adds to the overall experience and understanding of a virtual environment; in fact a message that adds environmental data that influences the way the viewer processes information, if not data in its own right. Cognitive psychology already views feelings as a type of information, allowing the feeling of 'being there' to be approached as such (Ortony, Clore & Collins, 1988, p. 66). As with other types of information design, the designer selects the data and treats it in the best way to convey the intended message, the viewer taking in the data, filtering it and combining it with their pre-existing thoughts and experiences to create understanding. Figure 1 represents the theoretical parity between presence and information design.

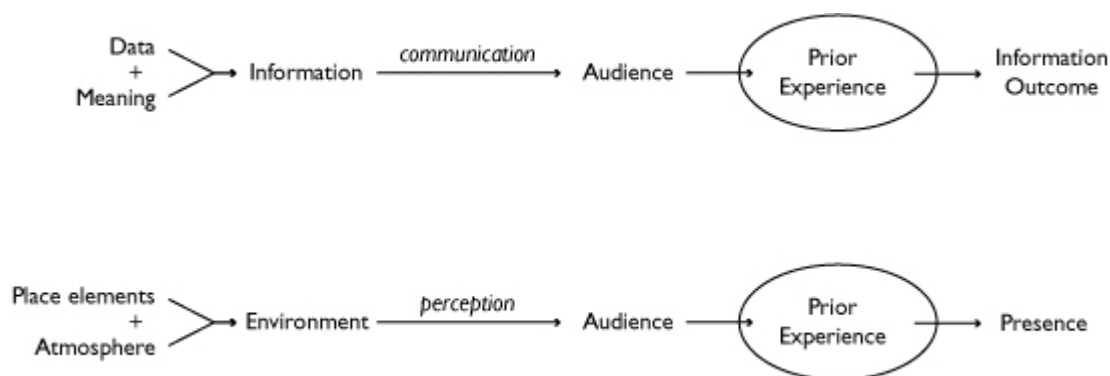


Figure 1. The theoretical parity between presence and information design.

If the research only concerned presence as a form of information design, interdisciplinary investigation could stop there. However, a key argument for attempting interdisciplinary research is the capacity to address the complexity of questions in the contemporary world. Issues of presence in virtual heritage do not only concern the forms of delivery. They also touch on issues of content that the design researcher needs to understand, the value of synthetic design research arguably being the useful connections it identifies between other areas of research. Key to processing environmental data to create a new understanding about a heritage site is the question of user experience. The theory of experience, or phenomenology, and the design-focused practice of experience design are two integral fields in respect of the applied project and the research questions. There is a negligible scholarly literature on experience design, demonstrating the benefits of interdisciplinary research in building

knowledge and understanding in design. By contrast, psychology provides a rich body of knowledge on human experience. Previous researchers incorporated cognitive psychology into information design to strengthen the field. There is potential to incorporate phenomenological psychology into experience design to create stronger theoretical research in this area. The fields of human computer interaction (HCI) and interaction design already look to phenomenology to address issues of user experience and design (Blythe et al., 2007). HCI and interaction design are not synonymous with experience design; rather experience design can be viewed as an overarching transdisciplinary field defined by the common goal of creating experience that encompasses some of the literature in these fields.

3. Emerging issues of the applied project

In considering how to design presence into digital 3D virtual heritage environments various bodies of research are relevant. Kenderdine's paper (2007) on Place-Hampi introduces the idea of interpretive virtual heritage, which synthesises aspects of archaeology, cultural heritage and interpretive archaeology, the practice of interdisciplinary research potentially suggesting diverse new areas to explore and leading the researcher into areas progressively more tangential to the original research question. In this research, the needs of the applied project established a cogent set of questions that suggested which areas of scholarship outside design were relevant to the investigation. Virtual heritage has to meet the needs of art, entertainment and science. It must be entertaining enough to capture and hold an audience's interest (Mosaker, 2001, p. 23), but accurate enough to present a reliable representation of a site (Mosaker, 2001, p. 21). Authenticity occurs on two levels in a virtual heritage model: believing by seeing and believing through authority. An audience can maintain scepticism when reading a description of a place, but providing a visual interpretation adds believability, the audience trusting the evidence before their eyes (Mosaker, 2001, p. 21). There is additional trust if the model is created under the auspices of a museum, which adds a sense of authority not present in a medium such as a computer game (Walsh, 1997).

Yet, the concept of truth is problematic. Truth in virtual heritage may initially seem to dwell in the physicality of a site, the notion being that the more visually accurate you make a model, the more truth it contains (Roussou & Drettakis, 2003, p. 2). But the nature and meaning of a heritage site reside not only in bricks and mortar. It involves the context of its cultural significance, the historical interaction of groups of people with the site, the experience of the individual and the changing nature of the site over time; all elements that form a subjective narrative in constant flux (Champion, 2007, p. 6; Champion & Dave, 2007). The problem for the virtual heritage designer is that the technology that creates, transmits and displays a 3D digital model constrains its form. The changing nature of a site over time is complex, difficult to program and results in huge file sizes that are slow to download. People interacting with a digital environment bring different cultural expectations to the experience to

those of a site's previous inhabitants. This is problematic enough with a single user, but hosting large numbers of virtual visitors creates additional problems of authenticity. People interacting with a site and each other according to modern cultural norms will erode the character of the original and create a feeling of digital tourism (Champion, 2007, p. 2).

4. Interdisciplinary solutions

Various non-design fields shed light on these problems. Presence research and interpretive archaeology identify the gap between contemporary viewers' experience of a site and that of previous inhabitants. They suggest the viewer will filter what they see through their personal experience, resulting in very different understandings of a site (Champion, 2007, p. 5; Hodder, 1991, p. 8).

Interpretive archaeology argues that commonalities in human experience mean the emotional impact of a site is often similar. People will move through the site in certain ways due to the geography and architecture, causing them to see the same things, be overwhelmed by the size of objects in the same way or be captured by a site's details (Brück, 2005). This offers a potential solution for the designer seeking to enhance presence through design.

In the conduct of the design project, technology both solved research questions and created additional problems. Co-presence, or the experience of being there with other people, is possible using the ExitReality 3D Web browser plug-in (ExitReality, 2009). However sharing the ExitReality experience with others requires that files are uncompressed, resulting in excessively large files. It promises a valuable tool for co-presence in less detailed virtual heritage environments, but for virtual environments with large file sizes it is better to compress the file for download. The need to transmit the 3D digital file over the Internet presents intrinsic challenges, but also opportunities to explore the creation of presence within real-world limitations. The project uses X3D because of the availability of plug-ins for viewing X3D files on commonly used Web browsers. However, its modelling language meant a lack of bump maps and shadows for most plug-ins; ensuring small file size necessitated reduced model complexity, resulting in reduced photorealism and detail. To disguise the lack of detail, the scene was set at twilight, highlighting one of the striking details of the temple, the darkness of the site enabling the columns to be lit from below as happens at the actual site.

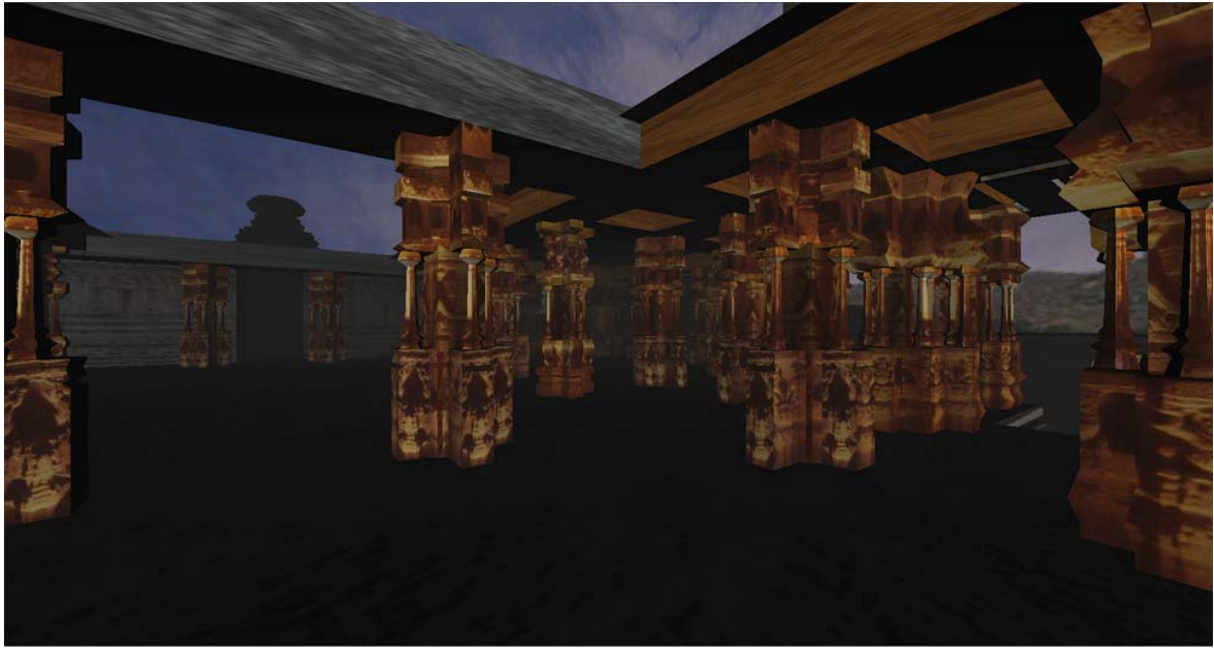


Figure 2. Screen capture of the view from inside the central monument in the virtual Vitthala temple.



Figure 3. Screen capture of the central monument of the virtual Vitthala temple.

The technical limitations resulted in a scene that felt quite austere. This was in keeping with the photographs on which the virtual environment was based, but resulted in a reduced audience experience. Viewers could navigate through the scene and explore various parts of the temple, but there was no other incentive to interact with the environment. An intuitive design response is to increase photorealism through additional detail, but produces files that are far too large in size. Rather than look to design research for a solution, the answer was found in presence and interpretive archaeology. The next phase of the project will draw on co-presence and include a narrative

exploration of the site's cultural context. X3D allows for movie files to be used as textures in a digital environment. The plan is to create movies of people interacting with the site according to the changing cultural context of the temple. These movies will briefly flicker in and out, creating a ghost-like effect. The characters in the movies will be drawn from the site's long cultural history—priests, gods, religious pilgrims, groups of contemporary school-children visiting the temple—and will create a story of the site's unfolding use over time. This will give additional understanding of the site's context for its audience, add to the historic and spiritual atmosphere of the virtual environment and avoid the typical pitfalls of non-person controlled avatars: the lack of potential interaction with viewers, obstruction of the viewer's navigation should they bump into a character, or conversely the unnatural experience of walking through a character that is supposed to be representing a solid person (Champion, 2007, p. 2).

5. Conclusion

This project demonstrates that interdisciplinary research offers new opportunities and knowledge for design researchers. By qualifying the research question, the applied project makes design issues central to the study, suggesting new solutions to the problem of designing virtual heritage within real-world parameters that might otherwise not be considered. Further research into the convergence of experience design, presence, phenomenology and information design has the potential to reveal more evidence about how to design digitally responsive environments in diverse public contexts given the expanding role of information technology in society, its increasing capabilities meaning fewer limitations constraining digital design in the future.

Reference List

Aram, J. D. (2004). Concepts of Interdisciplinarity: Configurations of Knowledge and Action. *Human Relations*, 57(4), 379-412.

Biocca, F. (1997). The Cyborg's Dilemma: Embodiment in Virtual Environments [Electronic version]. In: *Humanizing the Information Age* (pp. 12-26). Proceedings of the Second International Conference on Cognitive Technology; Aizu-Wakamatsu City, Japan, 25-28 August 1997, IEEE Computer Society Press.

Bracken, C. C. (2005). Presence and Image Quality: The Case of High-Definition Television [Electronic version]. *Media Psychology*, 7, 191–205.

Brück, J. (2005). Experiencing the Past? The Development of a Phenomenological Archaeology in British Prehistory. *Archaeological Dialogues*, 12(1), 45–72.

- Bruhn, J. G. (2000). Interdisciplinary Research: A Philosophy, Art Form, Artifact or Antidote? *Integrative Physiological and Behavioral Science*, 35(1), 58-66.
- Buchanan, R. (2001). Design Research and the New Learning. *Design Issues*, 17(4), 3-23.
- Candlin, F. (2000). Practice-based doctorates and questions of academic legitimacy. *International Journal of Art and Design Education*, 19 (1), 96-101.
- Carassa, A., Morganti, F., & Tirassa, M. (2005). A situated cognition perspective on presence. In: B. G. Bara, L. Barsalou, & M. Bucciarelli (Eds.), *Proceedings of the 27th Annual Conference of the Cognitive Science Society*, (pp. 384-389); Stresa, Italy, July 21-23 2005.
- Champion, E. (2007). When Windmills Turn into Giants: The Conundrum of Virtual Places. *Techné: Research in Philosophy and Technology*, 10(3), 16.
- Champion, E., & Dave, B. (2007). Dialing up the Past. In F. Cameron & S. Kenderdine (Eds.), *Theorizing Digital Cultural Heritage* (pp. 333-347). Cambridge: MIT Press.
- Choi, B. C. K., & Pak, A. W. P. (2006). Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness. *Clinical and Investigative Medicine*, 29(6), 351-364.
- Cross, N. (1999). Design Research: A Disciplined Conversation. *Design Issues*, 15(2), 5-10.
- Downton, P. (2003). *Design research*. Melbourne: RMIT Publishing.
- Durling, D. (2002). Discourses on research and the PhD in Design. *Quality Assurance in Education*, 10(2), 79-85.
- ExitReality - The Entire Web in 3D (n.d.). Retrieved June 30, 2009, from <http://www.exitreality.com>
- Floridi, L. (2005). The Philosophy of Presence: From Epistemic Failure to Successful Observation. *Presence: Teleoperators & Virtual Environments*, 14(6), 656-67.
- Friedman, K. (2003). Theory construction in design research: criteria: approaches, and methods. *Design Studies*, 24(6), 507-522.
- Golde, C. M., & Gallagher, H. A. (1999). The Challenges of Conducting Interdisciplinary Research in Traditional Doctoral Programs. *Ecosystems*, 2, 281-285.
- Gusdorf, G. (1977). Past, present and future in interdisciplinary research. *International Social Science Journal*, 29(4), 580-600
- Heeter, C. (2003). Reflections on Real Presence by a Virtual Person. *Presence: Teleoperators & Virtual Environments*, 12(4), 335-45.
- Herrera, G., Jordan, R., & Vera, L. (2006). Agency and Presence: A Common Dependence on Subjectivity? *Presence: Teleoperators and Virtual Environments*, 15(5), 5.
- Hodder, I. (1991). Interpretive Archaeology and Its Role. *American Antiquity*, 56(1), 7-18.
- Kenderdine, S. (2007). *Somatic solidarity, Magical Realism and Animating Popular Gods: Place-Hampi "where intensities are felt"*. Information Visualization, 2007. IV '07. 11th International Conference, Zurich, Switzerland.
- Latour, B. (1991). *We Have Never Been Modern*. Cambridge, Harvard University Press.
- Lauer, J. M. (1984). Composition studies: Dappled discipline. *Rhetoric Review*, 3(1), 20-29.

- Lyotard, J-F. (1984). *The Postmodern Condition: A report on knowledge*. Trans. G. Bennington and B. Massumi. Minneapolis, University of Minnesota, 1984.
- Mosaker, L. (2003). Visualising Historical Knowledge Using Virtual Reality Technology. *Digital Creativity*, 12(1), 15–25.
- Ortony, A., Clore, G. L., & Collins, A. (1988). *The Cognitive Structure of Emotions*. Cambridge: Cambridge University Press
- Pedgley, O. (2007). Capturing and analysing own design activity. *Design Studies*, 28 (5), 463-483.
- Pedgley, O., & Wormwald, P. (2007). Integration of Design Projects within a Ph.D. *Design Issues*, 23 (3), 70-85.
- Roussou, M., & Drettakis, G. (2003). Photorealism and Non-Photorealism in Virtual Heritage Representation. In: A. Chalmers, D. Arnold & F. Niccolucci (Eds.) VAST 2003 and First Eurographics Workshop on Graphics and Cultural Heritage; Brighton, November 5-7, 2003. Eurographics.
- Samraj, B., & Swales, J. M. (2000). Writing in conservation biology: searching for an interdisciplinary rhetoric? *Language and Learning Across the Disciplines*, 3(3), pp. 36–56.
- Thompson Klein, J. (2004). Prospects for transdisciplinarity. *Futures*, 36, 515–526.
- United Kingdom Council for Graduate Education. (1997). *Practice-Based Doctorates in the Creative and Performing Arts and Design*. Retrieved June 28, 2009, from UK Council for Graduate Education website:
<http://www.ukcge.ac.uk/Resources/UKCGE/Documents/PDF/PracticebaseddoctoratesArts%201997.pdf>
- Walsh, P. (1997). The Web and the Unassailable Voice. *Archives and Museum Informatics*, 11, 77–85.