Whispering Walls

Cultural augmentation with augmented reality at a range of scales

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Abstract. A design project that explores how augmented reality may be incorporated within architecture to embed hybrid ‘info-tectonic’ detail, across a range of scales is documented. The context in which the project is undertaken is the legacy of South Indian temple design. This opens up a complimentary field of research within a cultural context, to locate another agenda for augmented reality in architecture. The idea of cultural augmentation and its articulation at a range of scales, from the tactile to the urban, was generated through the design project. By way of introduction this mode of research is discussed in relation to CAAD research methods. In conclusion, a general model for cultural augmentation with augmented reality as a scalar continuum is presented.

Keywords. Augmented reality, cultural augmentation, research through design.

INTRODUCTION

The general field this presentation addresses is the integration of augmented reality content within physical architectural space. Since the establishment of the ‘virtuality continuum’ (Milgram and Kishino, 1994) the CAAD community has developed a body of research which includes: an overview of the use of mixed reality within the built environment (Whyte, 2002; Wang and Schnabel, 2008); the proposition of onsite augmentation through ubiquitous computing (Seichter, 2008; Hii et al., 2009); and established an approach to the design of operational interfaces for navigating augmented reality within digital design environments (Belcher and Johnson, 2008). Building on some of this precedent, we report on a project that explores how realized architecture may embed augmented reality to provide hybrid ‘info-tectonic’ detail and through this propose cultural augmentation with augmented reality as a scalar continuum.

The context in which this research is undertaken is the legacy of South Indian temple design. This opens up a complimentary field of research within a cultural context. Researchers have investigated the role digitisation may play in the preservation of cultural artifacts (Bertuzzi, 2011; Noh, Sunar, and Pan, 2009). Research in the area has also discussed the role of craft and tradition in an age of great migration and that the design of the Indian temple has effectively been static for 500 years (Jena, 2010; Leibel and Trithankar 2004). There are a number of extensive surveys, both literary and illustrative that have been conducted on the classical forms of the South Indian temple (Tillotson, 1998). The carved temple walls developed by the people of the Hindu
culture existed as a tool to document and dictate a way of living. Trying to reproduce the temple, in particular the intricately carved surfaces, requires the skin to either lose fidelity through compromise in craft or require an enormous budget. It has been acknowledged that such traditions need to evolve in the age of digital interaction and consumption (Noh et al., 2009; Bertuzzi, 2011). By translating traditional handcraft ideologies to the digital medium of augmented reality, there is potential to empower a larger number of people who can engage, learn and continue to document their culture in a medium which is more flexible and responsive to a contemporary society.

A Note on Method
Architectural design research is typically understood as three interrelated modes of operation: research about design focuses on the methods, media and techniques that are used to carry out design; research for design is a broad term that encompasses studies that will enable a design, such as the development of materials or construction technology; while research through design examines a specific design context to develop an architectural proposal that embeds new understanding or insight (Downton, 2003). The three modes are interrelated and a design practice or research team might utilize all throughout the duration of a project. Research activity in CAAD has typically focused on the about - the impact of digital technology on design methods - or has developed technology such as environmental control systems for design. Quite often the CAAD research about or for design is undertaken within the context of a case study, which evaluates the enabling digital design tools or tests the performance of a technology prototype. However this is typically deductive and does not include the open ended iteration and experimentation that characterizes research through design. Moreover, the context of the case study is seldom fore-grounded, as the intent is to generate objective data to underpin the contribution to knowledge. Ideally the research uses a methodology that enables other researchers to repeat and validate the findings. By contrast research through the medium of design works from the particular site, programme and cultural context to develop a singular design. Rather than providing objective data or a repeatable experiment, the architectural design (paper project or realized building) provides a unique outcome. Clearly not all designs will make a contribution to knowledge, or even be worthy of critical debate. However innovation and insight can be embedded in the architecture, which on reflection by the designer or through critical evaluation can be communicated. This design knowledge can stimulate other designers and researchers, who may then look in more detail at the implications of the architecture. This in turn can lead to research that undertakes objective evaluation about the design method, or leads to the development of new technology for design.

The documentation of this project is an example of the strength and weakness of research through design as a CAAD method. Without the particular context of the South Indian Temple and the issues this poses for contemporary architecture, the designer would not have developed the scalar approach where the building is augmented as personal, public and urban interfaces to cultural information. The specifics of the project led to an approach to augmentation that addresses the lost relationship between an individual and the temple. Through reflection and dialogue between peers and critics, the scalar approach has been articulated as a general model for the application of augmented reality. However, the negative aspect of the method is that it is hypothetical, untested and while grounded in the trajectory of current research, it requires technical development. It is in this context that the design and its implications are documented. The project may stimulate other designers and researchers to explore the ideas of cultural augmentation and a scalar approach to augmented reality in architecture. Ideally, this would involve a methodology that enables the proposed interaction to be developed through ‘user-client assessment’ and ‘persona-based evaluation’ (Achten and Kopřiva, 2010).
CONTEMPORARY CHALLENGES OF SOUTH INDIAN TEMPLE ARCHITECTURE

South Indian temple architecture has not evolved for over a millennia and contemporary examples of South Indian temples still seek to represent the temple in the historic sculptural manner, which is no longer sustainable due to contemporary constraints of craft and budget. The once abundance of artisans in their respective fields of craft have now been reduced to a rare few among thousands. Along with this the purpose and meaning of their craft has also diminished (Kumaj Jena, 2010). The problem becomes particularly acute for contemporary Indian populations who have migrated all over the globe. While there are examples of highly ornate temples that have been constructed, the cost of these are typically prohibitive. In the context of New Zealand, this is very much the case where the local Indian community gather in a simple hall, which has lost the capacity to be a repository of knowledge and customs. In particular, the relationship between the observer and the wall has been lost. The fundamental aspect of the wall relief being the traditional means of cognitively processing cultural information has being lost. How might this tradition be revisited? Can advances in augmented reality be utilized to provide a contemporary version of the South Indian temple experience?

The potential of augmented reality for temple design

Augmented reality is typically defined in reference to the virtuality continuum as defined by Milgram and Kishino (1996), where the region between the two extremes of Real Environment and Virtual Environment is known as Mixed Reality, that breaks into sub-categories of Augmented Reality and Augmented Virtuality. Augmented Reality (AR), the overlaying of digital content onto the real environment has received much interest within the CAAD community. AR and algorithms for image tracking have existed since the early 90’s with an emphasis on head mounted displays linked to desktop and laptop computers. With the rapid production of powerful and portable smart devices such as tablets and smart phones over the past few years, the technology has been able to go mobile, thus entering the realm of the everyday user. Arguably, mobile AR holds the most promise for the future, particularly with the advent of wearable devices such as the Google Glasses projected to be available in 2014).

The focus of this study is on how AR may be incorporated into the experience of the building, as opposed to the use of AR as a design aid (Moloney and Dave, 2011; Seichter, 2003) or as a part of the construction process (Dunston and Shin, 2009). Our particular interest is in the use of mobile AR as the means to enhance the experience of a physical context. For example, HitLabNZ have been producing AR technology and content for museums around the world. One of their recent projects has been developing a mobile application for post earthquake Christchurch where architecture that was destroyed during the quake can be experienced once again through AR technology. Mobile AR applications seem particularly relevant when used to enhance cultural understanding. In this vein, the Museum of London has released an application that allows the user to experience digital copies of their art and photography in relation to the context it was created. As tourists visit key historic sites in London the GPS on their smart phone triggers alerts enabling AR content to be downloaded. As well as overlaying graphical or audio information to enable an engagement with historic context, there have been some experiments where AR has been used to literally augment architectural form, or to superimpose 3D virtual artworks in physical space. In terms of artistic practice Oliver (2009) has produced the most effective AR works, most notably his insertion series. The use of this approach has had minimal uptake at an architectural scale, beyond speculative proposals such as the nomad_tech museum (Moloney, 2010) or examples that overlay information onto a building facade such as the N-Building in Tokyo (Terdadesign, 2009).

Given the trajectory of the technology and the precedent, Mobile AR provides much potential for
the challenge of designing a contemporary Indian Temple, particular in countries like New Zealand where there is no access to Indian stone masons. It would seem AR may enable the re-engagement with the four historic scales of temple operation – urban / building / wall / artefact. As well as replicating traditional narrative and cultural repositories, there is potential for these to be enlivened with content tailored for a contemporary context, binding communities beyond geography and time. By providing the communities with the ability to learn and document through a digital medium, the temple may once again become an active reflection of contemporary society. We are interested in conceiving a hybrid AR architecture that may enable transplanted communities to establish a unique and relevant identity with their historic past.

THE DESIGN CONTEXT
In order to evaluate the proposition that a hybrid AR architecture may address the problems of re-inscribing the traditional role of South Indian temples abroad, a design has been undertaken for a site in Auckland, New Zealand. The design case study is documented in three parts: an analysis of a particular temple that became the key referent for the design; a description of the site context and overall architectural design approach; and a summary of how augmented reality enhances the architectural experience at four scales of operation.

Brihadeeswara Temple located in Tanjavur of the state Tamil-Nadu, India was chosen as the primary precedent for the design. The significance of this particular temple is the relationship with Auckland’s South Indian community who are primarily from Tamil Nadu. Known as the “Big Temple” it was constructed during the reign of the Chola Empire Circa 1010 AD, a time that was considered the height of temple architecture, engineering and classical arts movement in South India. Much like the Western approach to proportions using the Vitruvian man, (Oijevaar, 2007) reveals how Vaastu Purusha relates human proportions with the geometry of the square. The relationship with the square and temple architecture was revealed in more detail by (Meister, 1985) who suggest the use of an 9x9 and 8x8 planning grid system for temple architecture. The geometric relationships and height derivations of Brihadeeswara temple proposed by (Pichard, 1995) became the starting point for our architectural analysis of Brihadeeswara, upon which the 8x8 planning grid was overlaid to reveal the relationship between ritual spaces in plan and section. In a discussion with the head priest of Sri Ganesh Temple in Auckland it was revealed that the temple is typically considered a reflection of the human body. With this information, a study drawing was undertaken where the proportional image of a Stupa was overlaid onto the plan and section of Brihadeeswara (Figure 1). This revealed some remarkable geometric relationships, that have analogies with Western proportional systems. Furthermore, upon reading Pichard (1995) and experimenting with overlays, the nature of the mathematics allows for the proportions to operate at nested scales much like a hologram, down to the level of the individual carved Stupa.

Located 30km south of the Auckland CBD, New Zealand, is the town is the township of Papakura, New Zealand. The site is located towards the east end of Papakura lying on the fringe of the Industrial zone and hosts the current Sri Ganesh Temple with public parks within close proximity. A key feature on the site is a stream that originates from the high ground at Red Hills area further East of the site feeding back into the ocean around Pahurehure Inlet. Looking from an AR perspective, the site provides an opportunity for engagement with temple and the nearby suburbs, which are of significant Indian demographic. Visitors who come to the nearby Keri Downs Park have a direct line of sight to the temple where AR can inform the current activity of the temple such as weddings or festivals. On a larger urban scale the temple’s AR “field” can extend to key sites such as State Highway 1 that connects Auckland and Hamilton cities. The proposed design is based on a contemporary re-constitution of proportions revealed from the research into the primary precedent Brihadeeswara temple, Tanjavur (Figure 2). The Papakura re-design
Figure 1
Proportional analysis of the Brihadeeswara temple, Tanjavur.
is based on the same historic Modular Planning Square and anthropomorphic approach found in the plan and section of Brihadeeswara. The materials and construction details have been interpreted for a New Zealand context.

**Augmentation strategy**

The primary rational behind the temples re-design has been to use AR to reprise the lost relationship between an individual and the temple. This is explored in terms of four scales of operation. At the urban scale graphical information is overlaid such as the location the temple in the sky-line, star alignments of cultural significance, scheduled prayers and wedding ceremonies along with live audio streams of prayers from the temple (Figure 3).

At the scale of the building it is proposed that by using a combination of GPS and the facades as a marker, the underlying intricacy of temple mathematics and its intertwined relationship between traditional text and geometry is revealed along with detailed information related to the temple activity (Figure 4).

At a more intimate scale the temple walls consist of repositories for personal markers conceived as re-locatable bricks, where groups of bricks act as markers generating the AR content. Here the user can interact with cultural content across the wall at a read-only level. This is where most of the learning experience occurs as the user can recognise patterns in how the story is arranged in relation to the music and poses for dance.
At the personal scale by associating each “brick” to a family we start creating relationships between a physical object, the cultural content and an individual (Figure 5). As part of the design development, a range of objects have been prototyped that can be held and used to trigger information overlays using an AR application developed in Unity3D and Processing. These include a stainless steel extrusion that has been etched with polymer-based ink, within which is housed an engraved hardwood second level marker. A case has also been included, as the intent is that individual markers would be able to be
Figure 5
The exterior walls of the temple design (top left and bottom) consist of repositories for physical AR markers (top right) that enable access to public and family information.
taken away for editing by their owners.

CONCLUSION
The design case study provides an example of how architectural experience may be enhanced by AR technology. The case of the contemporary interpretation of a South Indian Temple, suggests much potential for considering AR as an integral part of architecture when there is a strong cultural component to the design brief. While the scalar strategy has been developed in relation to the traditional role of the temple, it provides a basis for others to consider the use of augmented reality as an active component of architecture. As illustrated, augmentation can be considered as a continuum from the urban scale to that of an individual artefact. At the macro scale an augmented building can be perceived as a new form of temporal landmark, which both orients and transmits information to a population. At the other end of the scale the artefact is treated as a personalized object that enables a tactile interaction, either residing in the building or travelling with the individual. In-between these poles is the typical scale at which architecture is conceived, the building and its surfaces, each providing complimentary opportunities for interaction that may enhance a users experience.

REFERENCES


