Mixed reality and curatorial design: from existing practice to the nomad_tech museum

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An innovative design visualisation environment that uses videogame technology and screen based augmented reality to support arts curation is presented. A follow on project, which exploits scale shifts and distributed presence, outlines one approach to extending the exhibition experience. The project is at the schematic design stage, with the emerging idea being miniature mobile galleries referred to as 'nomad_tech'. These are intended to have a mixed reality presence in the museum and other cultural settings, while been interactively linked to form distributed virtual environments.

Art museum. Mixed reality. Curatorial practice.

1. INTRODUCTION

The field of research addressed in these projects is the use of mixed reality technology within the context of the contemporary art museum. The focus is on technology to support typical curatorial design and secondly, the potential for mixed reality (MR) to enable an alternate form of art gallery, poised between physical and virtual worlds. The research is aligned with a large body of work on the use of mixed reality in other museum settings, where the primary focus has been on extending the visitor experience through interactive displays. The concentration on the provision of curatorial design support within the context of the Art Museum provides a point of difference with this body of work, with perhaps the closest precedents being current MR research at the University of Nottingham (Koleva et al., 2009). This presentation is in two parts: the design framework and prototypes of a visualisation environment for a contemporary art museum is presented; and secondly a follow on project exploring an alternate form of gallery experience is outlined, with the aim of generating discussion on new forms of curatorial practice.

The interactive visualisation environment was commissioned by the Potter gallery of Modern Art in Melbourne Australia. A prototype design application has been developed to enable curatorial staff to visualise exhibition designs in a format similar to an interactive 3D videogame. This enables curators to select from a visual database and arrange wall mounted artworks in elevation, which are then visualised in a three dimensional

model of the gallery in order to assess viewing angles and spatial sequence. Designs can be saved and alternative designs can be quickly generated and evaluated, allowing an iterative loop of [*select – arrange – evaluate*]ⁿ. Complimenting this virtual design environment, an augmented reality (AR) application allows the designs to be evaluated from within the physical gallery on a high definition LCD touch screen. The screen is placed at key viewing angles and artworks are composited within streaming video to facilitate design review to occur within the gallery space. When the design is completed the digital gallery model is intended to be used to support exhibition production.

While the prototypes enhance visualisation and facilitate design review they are conceived in terms of supporting 'traditional' curatorial practice. The design applications allow reasonably fluid experimentation with the placement of art works, potentially enabling alternate narratives between artists or periods to be explored, but the technology adds little advance to the gallery experience. How might these technologies be repurposed to provide alternate museum experiences for the arts surveyor? The second half of this presentation outlines one approach to extending the art museum experience, through the idea of 'nomad_tech' miniature galleries that exist simultaneously in physical space and as online virtual worlds. Using mixed reality technology the approach as envisaged here, exploits shifts in scale and distributed presence to extend the gallery experience. The aim is to both provide an alternate form of experience in the physical gallery and to

reach a potential new online audience, attuned to exploring 3D virtual worlds.

2. FROM PAPER TO VIRTUAL GALLERY

The visualisation project was initiated by a query from one of the museum administrators – could I make a digital model of the existing galleries to help with exhibition production? There was a certain pragmatism to these first discussions, with the request for a database linked to a digital model to enable better planning and management, in effect a request for a facilities management tool. My background is in the use of videogame technology to enhance architectural design had shown that real time models enable more intuitive design experimentation than typical computer aided design (Moloney & Harvey, 2004). Recently the use of video game technology has been used to create virtual museums (Matevitsi et al., 2008), but there does not appear to be precedent for using the technology to support curatorial practice. Not being particularly interested in facilities management, I suggested the project could be extended to the curatorial design process. A meeting with curatorial staff was arranged and the existing curatorial design method using a drawing / collage approach was demonstrated. The senior curator produced an A3 plan with photocopied artworks taped along the edges. The practice was to shuffle the photocopies around the plan in order to think through the exhibition designs, with the postage stamp sized representations provided the only visual cue for the curator. Given the curator's knowledge of the gallery spaces and that many of the exhibitions were based on the Museum's collection, this design practice had seemed satisfactory. However with a shift towards exhibiting new artist works, there was recognition that the use of digital visualisation would be useful.

At a subsequent meeting the broad specification for design visualisation support was agreed. The curators were not prepared to learn complex 3D modelling software but wanted a simple drag and drop interface to enable them to quickly visualise exhibition ideas. The initial focus was to provide a tool to facilitate wall hung artworks with the possibility to include three dimensional and media based works at a subsequent stage. The proposal was to enable the curator to select from a visual database of artworks and drop these onto 2D elevations of the exhibition walls. The artworks would appear at their accurate dimensions and 'snap' vertically to a centreline height of 1.6 metres (the eye height dimension preferred for this gallery). As more works are added they are automatically positioned horizontally to provide equidistant dimensions between works. The exhibition design can then be saved and through a 'one click' interface this is visualised in a real-time

3D model that operates similar to a first person videogame. The model was deliberately 'quasi-realistic', with the objective being to maintain a degree of abstraction while designing. Key viewing positions are preset and the designer can smoothly switch between these positions and / or explore the exhibition in free camera mode. A range of alternate designs can be stored and these can be accessed from within the real time model to enable quick comparisons from any viewing angle. As illustrated in Figure 1, this enables the curator to work in an iterative loop of simple 2D placement and automated 3D visualisation.

Figure 1: Overview of curatorial design prototype

2.1 Mixed reality in the art gallery

Mixed reality as defined by the virtuality continuum, (Milgram et al., 1994) is a term used to describe a range of visualisation technologies, from full virtual worlds to simple digital video of physical environments. Positioned between these two poles,

are augmented virtuality where streaming video of physical worlds are incorporated into digital models and augmented reality (AR), where virtual models are superimposed into physical environments. Typically AR is realised by using head mounted displays (HMD) together with position tracking technology. Digital data – text, images or 3D models – are superimposed onto the HMD and aligned with the viewer's shifting gaze. An alternate approach, and the one used for this project, is to use a screen that composites digital visualisation in real time with streaming video. The use of a screen, rather than the HMD's typically found in AR, facilitates group discussion of design alternatives as opposed to a singular immersive evaluation. At the University of Melbourne we are exploring screen based AR to support architectural design and have used the Potter Gallery project as part of the prototype testing for this larger funded project.

Figure 2: Screen based AR prototype, where 3D design models are aligned with streaming video (shown here in an external context). A touch screen interface enables interactive manipulation of the parametric design model and samples the video stream in real time, to update the model lighting to correspond with dynamic lighting

The prototype consists of a large LCD touch screen and video camera mounted on simple tripod with a graphics workstation and portable power supply in an adjacent cabinet. The touch screen interface and the use of a camera tripod allow all members of the review group to pan or tilt the screen around the gallery walls. Different designs can be easily accessed and compared on the fly. Lighting of the artwork can be simulated by adjusting position and strength of digital light sources that correlate with the gallery lighting tracks. For the prototype we used non-calibrated lights that enabled simple experimentation with position and luminance value, but there is capacity to incorporate accurately calibrated lights. Apart from correlating lighting of the model with the streaming video, one of the technical challenges of augmented reality is to support accurate real time position tracking, with

most solutions reliant on expensive hardware or complex computer vision software. In the case of the museum gallery, where the spatial perimeter is fixed and key viewing positions can be anticipated, there is less need for full motion tracking. For this prototype, the placement of the AR screen is pre-calculated and the tripod and cabinet can be easily positioned to the range of key viewing positions during the design review. Alternatively, streaming video from cameras located elsewhere in the gallery can be swapped with the tripod mounted camera, to enable different viewing positions to be explored without physically moving the tripod.

2.2 User feedback & further development

While we have not as yet undertaken full user evaluation case studies, initial feedback on both the curatorial design prototype and the AR review functionality has been positive. The facility to arrange artworks in two dimensions and then immediately visualise these in the virtual context of the real time model with minimal effort, met the user requirements. Curatorial staff with limited computer graphics experience are enabled to quickly develop visualisations and make more informed curatorial decisions. Moreover, the facility to save different designs and to swap these 'on-the-fly', will enable iterative designing and the capacity to return quickly to 'design mode' after a session is broken by other work commitments. It is anticipated that the three dimensional visualisation will be more significant when dealing with sculpture and installation works. To this end, the next stage of the prototype will enable a sculpture browsing interface. This will follow a similar design process of placement in 2D plan and visualisation in the real time 3D model. However the positioning requirements will be significantly different to working with wall hung artworks, where the vertical dimension and horizontal spacing are fixed. We will be incorporating the ability for the curator to adjust translation and rotation of artworks in 3 dimensions within the model, to enable refinement of the placement undertaken view in plan. We are also considering the development of a library of plinth objects that can be scaled to enable testing of shape and scale in relation to the sculpture. There will also be consideration of how video and interactive screen based media art works can be accommodated. The current software enables video to be controlled within the 3D model and the placement of spatialised audio, which may enable a start to be undertaken in producing an interactive curatorial design environment.

With regard to the AR prototype the objective was to enable discussion to occur within the gallery space with a wider group of staff. To this end, the touch screen interface and simple approach to motion tracking allows group discussion to occur

with minimal encumbrance. The graphic fidelity and the lighting controls are sufficient for discussion to occur over the relative positioning of one work to another and to initiate discussion over the lighting design for the exhibition. Developing photorealistic physically accurate lighting was not considered a high priority, as once positions of artworks were agreed and a general lighting design agreed fine tuning could occur with the actual lights. The value of the AR visualisation was not so much seen in terms of graphics fidelity, but more that of insight gained from being physically in the gallery while undertaking design discussions. The AR screen compliments the low resolution and more abstract curatorial design environment. Rather than attempting photorealistic visualisation at the sketch design stage, this was achieved by visualisation in the actual physical space. The evaluation is still interpretive – photographs of art works composited in streaming video are a poor substitute for the actual work – but being physically present in the gallery space, gave the visualisation a phenomenological resonance not possible within the videogame based design environment. A more lightweight and flexible AR prototype will be considered to compliment the tripod mounted touch screen. The obvious technical route is to develop applications for *itouch*, enabling curators to walk through the gallery space testing out curatorial designs.

Further work is also required to specify a production module to support exhibition production and management. The production module would use the same gallery model as the means to interface with a text database and will also be used to visualise installation requirements such as new cabling or lighting requirements. The text database will include full descriptions of the artworks, storage and handling requirements, copyright information, and didactic text to be used for the exhibition. The didactic text will be integrated with the 3D model enabling positioning in relation to the artworks.

3. EXTENDING PRACTICE

The above project was initiated by an art museum to examine ways in which curatorial design might be enhanced by digital technologies of visualisation and information management. The emphasis was on supporting typical gallery practice and while the curatorial design prototypes have yet to be utilised on an exhibition, the feedback from museum staff has been positive. The project and its further development will enable staff with no 3D modelling experience to visualise their designs, review these within the gallery space and integrate the design with a database to coordinate production. The project has used established and emerging technologies to support decision making, in effect,

the transfer of knowledge and techniques from architectural visualisation and production to the domain of arts curation. While this may enable more fluent and informed practice, the gallery experience for the arts surveyor is not enhanced. How might mixed reality technology be repurposed to further engage the surveyor, in particular, how might the audience for contemporary art be extended beyond those who regularly attend their local galleries?

3.1 Scaled Experiences

The use of scale shifts is a tactic familiar to contemporary artists, building on the natural intrigue of the miniature and the sublimely large. *On Longing* (Stewart, 1993) explores this fascination, tracing the genealogy of the miniature to the curiosity cabinet, in effect a miniature gallery within a museum. How might the fascination with the miniature and the large be extended through the use of mixed reality in the art museum experience?

Imagine a 1:20 scale gallery located within one of the typically vacuous foyers of a museum. Elegantly floating in space, the surveyor who has wandered through the entrance approaches the seductive architectural model to discover the roof removed. Peering down, s/he discovers an exhibition of contemporary art. From this viewpoint the art works are Lilliputian in scale: sculpted forms produced with digital precision through 3D printing technology; data projected generative artworks appear as high resolution post cards; wall relief of sublime intricacy. The floor of the gallery is translucent, and observable on the surface are shadows, clearly of human figures that appear to be surveying the gallery artworks. As s/he moves closer the shadows turn and seem to fix their gaze towards the roof, apparently making contact. Returning the gesture there is period of shadow play before the mutual surveyors return to exploring their immediate surrounds.

Adjacent to the miniature gallery are video consoles that on closer inspection provide viewpoints from inside the model. From a third person perspective, the gallery is transformed in scale with the reference being the viewer's avatar, a simple line profile and a shadow projected onto the floor. The gallery is a vast space of baroque scale, with the wall relief and sculpture now revealed in the intricate detail, only hinted at by the physical model. Video and other interactive media works are projected onto the gallery walls in high resolution and with spatialised sound. Some of the art works are using location tracking to enable the surveyor / avatar to interact with the works and it soon becomes apparent there are multiple shadowy surveyors occupying the space. Glancing

upwards reveals a view into another space, the space of the museum foyer as seen from a video camera within the physical scale model. A second visitor to the Museum foyer has discovered the scale model gallery, their head appearing Gulliver-like from within the virtual gallery. Visitor one and visitor two observe each other with equal curiosity.

3.2 Towards the nomad_tech museum

The focus of Mixed Reality installations in Art Museums has been on the combination of physical interfaces (typically AR markers embedded into small objects) and the visualisation of the subsequent interaction in large scale virtual environments. The pioneering 'Gulliver's World' (Lindinger et al., 2006) at Ars Electronica and the gamelab exhibition at the Australian Centre for Moving Image (ACMI), have been in the tradition of showcasing new technologies, rather than as a new medium for artists. However, leveraging from the use of video game technologies, there are a number of contemporary artists such as Julian Oliver, who are using mixed reality to display artworks. While we are not quite at the stage as portrayed in William Gibson's latest novel, the spectre of landscapes and cities dense with AR art is a likely scenario once the technology becomes more mature. Parallel to this vision of tech-enabled art outside the confines of the gallery, there is a growing interest in the travelling or 'Nomadic Museum'. The term is typically associated with the travelling *Ashes and Snow* photography and film exhibition by Gregory Colbert, while other high profile traveling museums have included the *Chanel Mobile Art Container* and the still currently touring *Hermès H Box*. This collapsible aluminium screening hall that exhibits the video art of eight international artists, has appeared at the Pompidou Centre in Paris, the Tate Modern in London and is currently in Japan at the Yokohama Triennale. Despite being conceived as temporary projects, it is notable that these nomadic museums have been large budget projects, targeted at the 'A list' of contemporary art institutions.

One of the promises of digital technology, in particular the online virtual gallery, was the potential for reaching a new audience and to enable regional galleries to link to larger art collections. While there are established online galleries, they do not appear to have gained much traction in the contemporary art museum sphere. They are neither engaging enough experiences to attract new arts surveyors, nor do they add anything more for those who regularly attend galleries. The description of the miniature gallery in the previous section suggests an approach that has

the potential to make the online gallery a more engaging experience and to extend the experience for the visitor to the physical gallery. As envisaged, the developing idea is for a series of miniature galleries either permanently associated with larger institutions, shared by smaller regional museums, or located in non-institutional urban or landscape contexts. The nomad_tech galleries, while existing as singular artefacts in their various physical locations, are linked from within their virtual spaces. Each acts as a mixed reality portal, enabling views out to the physical context for the virtual surveyor or as an intriguing miniature interactive for the physical surveyor. We are currently constructing a prototype in Melbourne and look forward to sharing our experiences and ideally linking to potential international collaborators interested in the concept.

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