

# Frolicking with Phantoms: Illusion in Mixed Reality

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This paper explores the induction of specific emotional effects upon individuals through illusion in mixed reality installation environments, using the author's work *Dislocation*, (2005) as a case study. The paper reports on the design and production of *Dislocation*, concentrating on the development of techniques for creating illusion. These approaches can be used to produce compelling works that are not only technically and aesthetically sophisticated, but also provide a sustained engaging experience for the user. It reflects on the effectiveness of these techniques from observations of audience interaction in gallery settings.

**D**islocation is a gallery-based interactive installation in which realtime video, audio and audience locational data are employed to create the illusion of additional characters inhabiting the installation space.

Over the last few decades there has been considerable activity in the fields of mixed, virtual and augmented reality research both in visual and aural implementations. Grau's examination of the field in *Virtual Art* indicates that there is a tendency towards immersing the viewers within the virtual world with a suggestive impression of 'immersing oneself in the image space, moving and acting there in 'real time' and intervening creatively<sup>i</sup>. These systems transport the user into an artificial realm distinctly removed from reality, or overlay artificial imagery over real physical space.<sup>ii</sup> By contrast *Dislocation* brings the virtual elements seamlessly into the physical reality of the participants, rather than transporting the audience into the virtual. In this sense the virtual and the real become indistinguishable. Although works such as Nigel Helyer's *Sonic Landscapes* examine this approach in aural form, there has been little development in integrated audio-visual systems<sup>iii</sup>. This shift of focus presents particular demands and challenges. How can such an illusion be successfully achieved? What is the significance of this shift in audience experience? Can the transition of virtual characters into the real world be used as a powerful and compelling emotional tool?

## 1. Illusion

There are two distinct forms of illusion that can be applied to create a fusion of the real and virtual. The first is evident in cinema and theatre whereby the audience, through suspension of disbelief, can validate the presence of a fantastical creature inhabiting the same space as a human. Although the viewer is immersed within this fantasy world, this

form of illusion takes place on a separate plane to the audience's lived reality. Many models of interactive systems that rely on suspension of disbelief for immersion to occur, such as Char Davies' *Osmose*<sup>iv</sup> and CAVE based VR<sup>v</sup> also operate within screen space rather than reality.

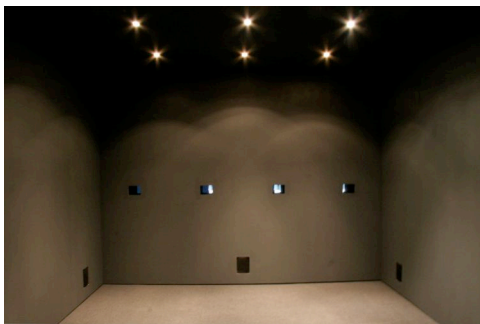
*Dislocation* does not work with such cinematic or theatrical techniques as the phantoms not only infiltrate the participant's world but do so unexpectedly. This has more in common with the second form of illusion; that used in stage magic, whereby the audience is involuntarily made to believe in the impossible inhabiting physical reality. In order to bring phantoms into the real world of the audience, the element of surprise is critical as Lokuge states:

The notion of willing suspension of disbelief applicable to theatrical performances is not apt in creating illusions. Since magic inherently relies on violating peoples expectation, asking audiences to willingly succumb to the effect of the illusion is purposeless<sup>vi</sup> (Lokuge 1995)

By violating expectations, destabilizing moments can be created in which viewers involuntarily exist within a hybrid world of physical reality and illusion

## 2. Dislocation – Installation Structure

The exhibition space itself is empty, apart from the small inset screens at the front of the room (portals). Concealed from the participants, a camera is embedded in the rear wall, and an array of eight speakers is mounted within the walls around the floor of the room.



The empty room is composed to create a feeling of normality, without any preconceptions of what may occur. As a counterpoint to the visual minimalism, an eight channel audio composition is presented in the room enveloping the audience.

Figure 1- Dislocation, FACT UK 2006 –Installation View

Over 100 phantom scenarios are available to inhabit the room with the audience via the portals and surrounding audio system. Lizzie Muller provides an overview of audience experience.

In Alex Davies's *Dislocation*, four small mounted monitors are set back in one wall of an enclosed installation space. You need to approach them closely to see what they are showing. It takes a moment to realise that what you can see is your own back, and those of your neighbours peering at the adjacent monitors. The screen flickers slightly, as if there is a minor disruption in transmission, and someone else enters the gallery, nearer to the camera, talking on a mobile phone. The sense of their presence behind you is spine-tinglingly palpable, as is the illicit feeling that you are eavesdropping on their conversation. But glance over your shoulder and you find the room is empty. The other presence was a phantom, a ghost in the machine.<sup>vii</sup>(Muller 2005)

### 3.Design Considerations

In order for the work to succeed a number of factors had to be addressed.

- Create a seamless illusionary environment that looked and sounded real.
- Control the audience within this environment for the illusion to succeed and be sustained.
- Inhabit this environment with suitable virtual characters and scenarios that could produce pronounced emotional responses within the audience.

#### 3.1 Perceptual Shift

In a perfect world *Dislocation* would fulfill Sutherland's ideas for the ideal computer display.

One must look at a display screen as a window through which one beholds a virtual world. The challenge to computer graphics is to make the picture in the window look real, sound real, and the objects act real.<sup>viii</sup>(Grau 2003)

Unfortunately the world is not perfect (yet). Many endeavors in the field of mixed reality focus on the use of 3D graphics to allow unconstrained views of objects so they seem to 'act real'. The primary goal for illusion in *Dislocation* was creating a tangible and realistic hybrid world that *looked* real. Pre recorded video sequences combined with spatial audio were used to achieve this.

The installation was designed so that the audience engaged with the work via an interface that was unencumbered by technology. This illusionary freedom enabled the viewer to inhabit and respond to the virtual world just as naturally as they inhabit real physical space.

#### 3.2 Visual Systems

All aspects of the environment were designed to lead the viewers into particular situations, without conveying the feeling of being obviously manipulated. This subtle influence was utilized to instill in the viewer a sense of freedom within the space, reducing any sense of abnormality in

the environment with the aim of enhancing the illusionary impact. If the audience has the impression that they are being manipulated then they will be more guarded and wary and not as susceptible or responsive to the illusion.

One challenge to the successful establishment of illusion was the intersection of phantoms and viewers within the physical space (when displayed through the portals). In an attempt to minimize collisions between phantoms and humans several techniques were used. Many of the phantoms were recorded to inhabit the rear area of the room. The entrance was positioned in a way to lead individuals towards the portals rather than having the audience enter the space and wander around randomly, thus reducing the chance of collision with the virtual entities. The entrance was closely situated to the front of the room to encourage users to move directly to the portals, the prominent focus of attention within the minimal room.

The portals themselves were positioned beneath eye height and set back from the wall so that to view the screens properly, the audience had to move quite close to the portals and lean forward. This provided two benefits. It further controlled the location of the live audience within the room and additionally, by making the audience peer directly into the portals at such a close proximity, removed much of the individual's peripheral vision. To this end, the portals acted as the viewer's only visual reference on reality within their surrounds thus immersing them further into the mixed reality they inhabited.

Certain contingencies were also implemented due to the fact that one can never fully predict or control the activities of the audience. In the instance when viewers did stray from the bounds of the portals, it was necessary to find a way to smooth over aberrations in the illusion when phantoms and humans collided. Instead of the viewer seeing a phantom walking through an audience member, a tracking and collision detection system was designed in which the live visual feed presented on the screens was temporarily distorted and the moment of impact. This gave an impression of a glitch in the system or breakdown in technology. The illusion is sustained and the audience has the impression that they inhabiting an unstable electronic environment.

### 3.3 Aural Systems

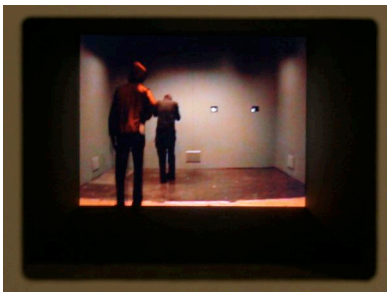
Sound is a powerfully emotive tool and particularly well suited to the creation of illusion. Sound is a pivotal aspect in *Dislocation* on two levels. Firstly it sets the overall ambience and secondly it is used as a device to heighten the sense of the visual illusion that the viewer is experiencing. Multi channel atmospheric sound was used to create a low level of tension within the room and broadly shape the audiences initial emotional state. The ambient base also facilitated blending of the live

and phantom sounds within the room, acting as an intermediary acoustic zone that both worlds fluidly shifted between.

Sound design techniques from conventional cinema such as off screen sound were applied to the world of mixed reality installation. The presence of the phantoms could be heard prior to their entry into the room, just as one would perceive the impending entrance of a live audience member. These initial spatial audio cues were utilized to setup the forthcoming visual illusion that was about to unfold. Upon visible entry into the environment, sounds generated by the phantoms were spatialised via the eight channel speaker array so that virtual footsteps would move around the room in conjunction with the phantoms movements, mobile phones rang next to you as the phantom reached for their phone and shrieks, laughs, barks and kisses all spatially drifted around with their virtual counterparts. Although the illusion could have succeeded without the use of spatial audio, there is no doubt that this added further depth to the illusion, ingraining the veracity of situation deeper within the viewers mind.

### 3.4 Virtual Presence

The framework of the system permitted a nearly limitless array of possibilities for the development of the hybrid phantom presence. Given that human beings respond strongly to the presence and behavior of other humans in their immediate surroundings, developing an illusion of the presence of others was a powerful way of engendering emotional reactions in the participants. Emotional response could have been achieved via other means such as architectural changes to the space or even abstraction of the environment, but the ability of humans to readily connect with other humans (both real and virtual) appeared to be a logical starting point for these investigations.



A number of video sequences of virtual characters appearing in the space were developed to explore the potential resonance between the live subject and the virtual characters. Beyond the successful implementation of illusion, the choice of scenarios was the next most critical decision. Several broad categories of emotion were

Figure 2 – View of live phantom/human image composite via portals (the phantom is present in the rear of the room with audience member located at portal # 2)

considered as starting points for the scenario development. These encompassed curiosity, discomfort, happiness, confusion, and fear and were manifested through over 100 pre recorded video sequences.

Two subsets of phantom interactions were developed with an aim of evoking these responses in the audience. These took the form of passive and active interactions. Passive activities included phantoms simply inhabiting the same environment as the viewer, a virtual gallery visitor passing through or a transient conversation between two phantoms. Active interactions were based around direct connections with specific audience members. For instance, if an individual was located at portal number one, a phantom would enter and precede to address the viewer, begging for money, whispering to them, or being aggressive and physically threatening. These virtual entities were critical to forming the substance of the hybrid world. They not only provided the initial perceptual shift but also sustained audience engagement through emotionally compelling situations and the construction of narratives.

#### **4. Technical Realisation - Illusion on a Shoestring.**

*Dislocation* was developed with consumer grade technologies and programmed within Max/MSP. In order for the illusion to succeed the phantom overlay had to mimic the quality of the CCTV video feed being transmitted to the portals that served the function of the viewer's reality. The compositing solution was achieved by the use of Chroma

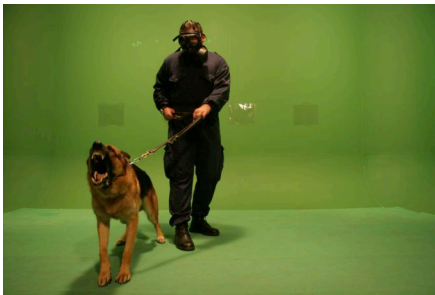


Figure 3 – Production Still – Phantom Chroma Key Shoot

Keying. Actors were videoed within a green cyclorama and digitally separated from their background, ready to be composited within the live exhibition space. As the aim of the work was to create the most realistic and compelling illusion possible, approximately 130 scenarios and permutations were

recorded that were tailored to various audience situations within the exhibition space. A database and tracking system was then used to present the most appropriate scenarios for a given audience. For instance, if individuals were at portal number 1,3 and 4, a phantom could be presented who, mimicking an audience member, would enter the room, walk up and peer into portal number 2, giving the impression that they were standing right next to you and engaging with the work.

#### 4.1. Tracking the Real and Virtual

This form of basic intelligence within the software engine was developed through analysis of the video images from the camera at the rear of the room. The camera not only provided the video stream that was processed and presented on the portals, but also provided critical data on the activities of individuals in the space that could be interpreted and applied to the system. Minor flaws in the visual system would cause the illusion succeed or fail. An essential aspect of the development of the work was to have a clear understanding of the activities of the live individuals in the space and the subsequent location of the phantoms in the selected scenario. The reason for this was twofold. It was necessary to ascertain the location of the audience at the portals in order to tailor specific scenarios to the immediate configuration of individuals in the space. It was also critical in identifying if phantoms and humans collided in the space, thus destroying the illusion. Without this level of environmental information, only a rather superficial mixed reality could be presented, lacking the required depth necessary to create a sustained and engaging audience experience.

### 5. Outcomes - Human Interaction in a World of Illusion

Dislocation, much like many practical investigations in the field was primarily developed in a speculative mode informed by prior research experience. The public experimental phase of the research was undertaken in presentations at *Experimenta Vanishing Point*, Blackbox Melbourne 2005 and *Experimenta Under the Radar*, FACT, Liverpool UK 2006. During these presentations audience behavior within the installation was recorded to video and provides the basis for the following observations.

#### 5.1 Reflection

The first and most basic form of interaction is that of the viewer interacting with their own reflection, their presence in the screens. Even in the absence of any manipulation of the image, viewers found this in itself compelling enough. This was accentuated in the case of multiple individuals being present at a given time as will be examined later. Merely the minor shift in perspective is enough of a transformation to provide the audience with as Rokeby states:

a wayward loop of consciousness through which ones own image of ones self and ones relationship to the world can be examined, questioned and transformed<sup>8</sup>(Rokeby 1996)

Although this perceptual shift provided within the video system was incidental, it informs the subsequent interactions the viewer has with the phantoms. Some users report that this rear perspective of their environment was in itself uneasy and disconcerting, thus placing the

viewer in receptive a psychological state for the forthcoming phantom arrivals.

## 5.2 Human and Virtual Presence

The second layer of interaction inherent in the work is that of the viewer and the phantom presences in the space. This takes several forms. Initially there is a fleeting moment when seeing a phantom inhabit the space, and hearing their movements within the room, that illusion becomes reality.



Observation of user responses indicate a significant proportion of individuals doing a 'double take' at this moment, looking in the portals, turning around to clarify their reference of reality and then returning their gaze to the portals to verify what they think they perceived. An interesting twist on this moment took the form of

Figure4 – Audience Interaction, FACT UK 2006

triple takes whereby a phantom would enter, the viewer would establish that they were a virtual entity within the space and continue to view scenarios as they played out. Another audience member would walk in to the space and the initial viewer would think they were in fact another phantom, only to be ever further astonished to turn around and see a physical form behind them. This blurring of the boundaries between the real and the virtual is the point in which viewers are particularly immersed in the work, their perception consumed by the system.

## 5.3 The Unexpected

Initially I had envisaged that the more psychologically intense scenarios such as direct violent confrontation with the viewer would have the most significant emotional impact. It became evident that this was often not the case. The scenarios that were surprisingly effective were the passive interactions. These were primarily based upon phantom activities that took place within the space, but often had not direct link to the presence of the individual viewers within the environment. In these instances, scenarios such as virtual gallery visitors entering and leaving the space, phantoms walking into the space to have their mobile phones ring, and other banal aspects of everyday life provided some of the most pronounced effects of the audience. The sheer normalcy of the situation and reflection of the everyday made the illusion more tangible and potent.

An unusual recurrent theme of audience interaction was alarmingly based upon violence. For a small proportion of the participants, the only form of expression or ability to connect with the virtual presence was limited to kicking and punching the phantoms. This was particularly popular with children who are notorious for assaulting interactive arts. Witnessing adults however, throwing punches at non-confrontational phantoms or kicking their legs back from the portals as the phantoms approached was mildly disturbing. The response was not incited by fear but seemingly out of an inability to connect in any other manner.

#### 5.4 Multi User Interaction and Sustained Engagement

A clear distinction became apparent between single user behavior and the behavior of groups. Although the initial illusion achieved the same impact upon individuals and groups, subsequent activity differed considerably. Individuals appeared much more likely to focus on the phantoms, remaining at the portals as the various scenarios unraveled. After the initial disbelief, the work was experienced more like a mutated form of cinema. When two or more individuals were present in the space there was considerably more interaction between virtual phantoms and humans alike. Audience members, mediated through the screen-based environment became more playful and performative. The portals provided a novel medium for viewers to stage their own undertakings. Viewers used the unusual visual perspective to run, jump, dance, kick, hug, and display nearly every other form of human exchange in between, to the scrupulous eye of the portals. Even in the absence of additional phantom presences, *Dislocation* provided a framework that was unorthodox enough to generate unexpected social interaction.

As the illusion slowly unravelled, the strings revealed, the smoke and mirrors drifted away and the virtual world unfurled in the audience's perception, a distinct shift in experience of the work became apparent.

I watched people dissolve in delight over and over again, drag in unsuspecting companions and relish the moment of being duped. Even after this moment of realisation, the images of the ghostly others occasionally behaving in inappropriate ways remains compelling. The small audience shivers at each new arrival like ouija board conspirators.<sup>9</sup>(Muller 2005)

Engagement and interaction are sustained after the illusion has faded through the playful and performative potential of the space. The addition of phantoms into the environment shifts the initial interactions between the viewers present by providing additional playmates to interweave into their own personal narratives. Individuals leave the portals for closer interchange with the phantoms whilst the other viewers watch on as the performance unfolds.

*Dislocation's* ability to sustain audience interest beyond the primary

illusion also lies in the anticipation of what will unfold. Viewers savor the momentary loss of control over the world they inhabit and the charged tension of the unexpected.

## 6. Conclusion

*Dislocation* attempts to create a mixed reality environment in which the virtual world inhabits the viewers' physical reality. By utilising convincing techniques of illusion to distort the perception of individuals, compelling works can be created that encourage sustained user interaction and engagement on several levels. In light of the public presentation outcomes, the work clearly succeeded due to the pronounced and visceral reaction of audience members. Further investigation into the nature of emotional response to virtual human presence in these environments (ie, the unexpected success of the banal and everyday scenarios) would be pertinent for future progress. The phantoms not only provided individual narratives but also gave rise to unexpected social interactions between humans. The surprising ability of these virtual entities to mediate and influence the behaviour of the audience clearly shows scope for further applications that the work initially did not set out to investigate.

Though *Dislocation* succeeded in both looking and sounding real, there was a deficit in the ability of the virtual forms to 'act real'. Due to the use of pre-composed video sequences only a superficial degree of audience interaction is possible. This can be solved by the use of 3D graphics but to the detriment of 'looking real'. Due to the current level of sophistication in computer technologies, further exploration into methods that provide a higher degree of exchange between realistic video representations and humans is necessary and would extend the potential and depth of mixed reality installations.

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<sup>i</sup>Grau, O (2003) *Virtual Art, From Illusion to Immersion*, Cambridge, MIT Press P.4

<sup>ii</sup> Azuma, R (1997) *Survey of Aug Reality In Presence: Teleoperators and Virtual Environments* 6, 4 pp355-385.

<sup>iii</sup>Robert, C (2004) *Sonic Landscapes*

[http://www.qmat.unsw.edu.au/snap/new/sonic\\_demo.htm](http://www.qmat.unsw.edu.au/snap/new/sonic_demo.htm)

<sup>iv</sup> Wilson, S (2002) *Information Arts*, Cambridge, MIT Press, p700

<sup>v</sup> Shaw, J Weibel , P (2003) *Future Cinema ZKM*, MIT Press pp 492-497

<sup>vi</sup> Lokuge, I (1995) *Dynamic Magical Environments*, Media Arts and Sciences MIT p11

<sup>vii</sup> Muller, L (2005) *Evocative Objects, Strange Selves*, *Realtime Issue* 70

[http://www.realtimearts.net/rt70/muller\\_vanishing.html](http://www.realtimearts.net/rt70/muller_vanishing.html)

<sup>viii</sup> Grau, op. cit., p162.

<sup>ix</sup> Rokeby, D (1996) *Transforming Mirrors*

<http://homepage.mac.com/davidrokeby/mirrorsmirrors.html>

<sup>x</sup> Muller, op. cit.