

**“Augmenting Visual Faculties:  
An Exploration of Traditional and Experimental  
Augmented Reality Methods in Artistic Practice”**

**MA Project Paper**

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**SECTION B: BODY OF WORK / THEORETICAL DISCOURSE**

**Overarching Theoretical Discourse and Themes Across Both Methods  
Utilized**

**SECTION C: TRADITIONAL AND EXPERIMENTAL TRACKING METHOD**

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**Process**

**Project Themes and Theoretical Discussion:**

**Theme: The Stereoscope and Virtual Voyages**

**Theme: Possessing the Miniature**

**Theme: The Miniature and Compression**

**Theme: Secretive Containers and Database Storage**

**Project 2: AR Pop-Up Dollhouse**

**Process**

**Project Themes and Theoretical Discussion:**

**Theme: Fractured Illusion**

**Theme: Issues of Scale**

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**“Augmenting Visual Faculties: An Exploration of Traditional and Experimental  
Artistic Practice in Augmented Reality Methods in Artistic Practice”**

**MA Project Paper**

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**SECTION A: INTRODUCTION**

**Introduction to Augmented Reality**

Augmented Reality (AR) is the convergence of the real and the virtual, consisting of the overlaying of computer-generated images onto a physical environment, which is interactive in real-time. Unlike Virtual Reality (VR), AR enables the user to view the ‘real world’ simultaneously with virtual imagery, which is layered atop real locations and objects. The form of AR technology I worked with to create this project is based upon a series of black and white square markers called fiducials. A web camera is utilized to capture images of the real world, which are then sent to a computer. Software on the computer searches through the live video stream for the various square markers. Once the software has recognized an AR marker, the marker is replaced with the corresponding imagery to create the final output, which is overlaid onto reality. (See Figure 1, Appendix)

Ronald Azuma’s definitive paper “A Survey of Augmented Reality” (1997), critical in establishing AR as an emerging research field, described various applications, the characteristics of AR systems and the technology, and future directions. Azuma makes note that AR systems are primarily found in academic and industrial research laboratories, which remains true for the most part today; however, a complementing article, “Recent Advances in Augmented Reality”, was published in 2001 by Azuma et al.



indicating the rapid technological advancements, including AR Toolkit, an open-source software library for building AR applications, which became widely available. The invention of the AR Toolkit by Dr. Hirokazu Kato of Osaka University, Japan, was a critical moment in making AR accessible to explorations outside of industry, owing to its low cost implementation and ease of use. The increased accessibility also motivated a search for the potential for applications of artistic work, which this project endeavors to explore.

### **Project Contribution**

AR research and development is being led by commercial industry: the military, manufacturing, and entertainment. AR is predominately being explored as an annotation and visualization tool, including such examples as superimposed instructional guides and assembly notes for workers in manufacturing processes (Doil et al., 2003), (Dangelmaier, et al., 2005), and AR guided surgery (Azuma, 1997), (Fuchs et al., 1998), (Vidal et al., 2006). Applications for cultural tourism projects are also being examined in AR, which offer enhanced interactive audio and visual walking tours, including three-dimensional real-time constructions of ancient sites (Vlahakis et al., 2001), (Papagiannakis et al., 2005). Narrative elements and the opportunities for immersive dramatic experiences in AR are beginning to be explored for educational uses (Kaufmann, 2002), (Woods et al., 2004), and entertainment purposes (MacIntyre and Bolter, 2003), (Hughes et al., 2005), (Stapleton and Hughes, 2006). The visualization of the medium itself is also a new area of investigation; computer engineers are experimenting with non-photorealistic imaging, including painterly and abstract visualizations (Haller, Landerl, and Billinghamurst, 2005).

As mentioned previously, the invention of the AR Toolkit software library created an opportunity to enable greater access to individuals outside of industry. One limitation of the AR Toolkit, however, was that it required knowledge of computer programming, which generally excluded artists from working with the software. DART (Designer's Augmented Reality Toolkit), developed at the Georgia Institute of Technology, and available for free download on the Internet, is intended to bridge this gap by "enabling designers to work directly and effectively with AR" (MacIntyre et al. 2004). Utilizing the AR Toolkit software library, DART is implemented on top of Macromedia Director, a multimedia development program with a robust design environment, which requires little programming to create simple experiences. Knowledge of programming can also be applied to create complex systems in the same environment. In the article, "DART: A Toolkit for Rapid Design Exploration of Augmented Reality Experiences" (2004), MacIntyre et al. acknowledge how AR researchers, including their own team, have explored AR predominately as a task-focused domain, ranging from equipment maintenance to medical applications. The authors identify how in collaborating with new media designers over the past few years, their views have shifted from "AR as technology" to "AR as medium", steering their attention to more experiential domains such as educational dramas and applications in entertainment (MacIntyre et al. 2004: 197).

MacIntyre et al. postulate that, "Designers are most effective when working directly with a medium, and working through an intermediary seriously hinders (or even destroys) the creative process" (197). The authors illustrate this point with the example of the difference between a painter directing an assistant as to where to apply paint on a To

canvas, rather than holding the brush oneself. Although I experimented with DART in the initial stages of my prototyping process, I did not utilize this application to create my final works. (This process is detailed in Section C, “Introduction to AR Software Utilized in Traditional Marker-Based Tracking” p.27) However, I do feel it is important to reflect the views of DART’s developers and to stress the importance of the artist being able to work directly with AR, as well as the potential for AR as a medium in itself, not only as a “task-focused” technology.

The potential for various artistic applications of AR is tremendous and can be extended to investigations in immersive environments and narrative, including interactive cinema and storytelling, as well as to more formalist explorations in three-dimensional digital painting, sculpture, and montage. This research aspires to contribute creative work and knowledge to the realm of AR as medium and art form, with a focus on interactive cinema, framing the projects created and the technology utilized within a theoretical discourse and a practice-based research model. This work could serve to fuel further study in understanding the possibilities for artistic expression in AR, and how tools may be improved to suit the needs of artists. This, in turn, could aid to help guide further innovation in the field of AR by enabling artists to conduct experiments and meaningful work in parallel to investigations in industry to assist AR in reaching its full creative potential.

### **Learning Objectives**

The learning objectives set and achieved for this project are as follows:

1. To further hone and develop new technical production skills within AR by completing a series of creative projects working directly with the technology. To

understand the technological possibilities and limitations of AR and push the boundaries of the medium creatively.

2. To conduct research in this emerging field across disciplines, surveying both historical literature and contemporary theory pertaining to AR as a creative medium.
3. To adapt an interdisciplinary approach in this work, applicable to both practice and research, building upon and bridging my background in Communication and Culture, Fine Arts, and New Media.

### **Introduction to Method and Process**

The final project resulted in a series of artistic works applying both traditional and experimental AR methods. The various AR artworks created compose a body of work that are intended to be viewed as a series resulting from two streams of exploration: traditional marker tracking methods, and experimental processes with non-marker images and alternative materials.

My experience in working with AR began with traditional marker-based tracking methods and building tactile objects based upon this recognition system. My creative work in AR evolved into experimental processes and applications that attempted to push the limits and boundaries of marker recognition and tracking, as well as the materials employed. Both methods entailed sketching and imagining creative possibilities through journals and a process of trial-and-error in examining and understanding how the technology functioned, in turn working within and around the restrictive parameters encountered.

ARStudio, developed by the National Research Council (NRC), Institute for Information Technology, in Ottawa, Canada, by Gerhard Roth in the Computational Video research program, was the AR software I employed to create all of my AR works. The processes entailed in the production of each piece using ARStudio, in both traditional and experimental methods, will be discussed in greater detail in each respective methods section. This paper is organized in the order of which these methods were investigated, with the traditional method explored first, in attempt to understand the possibilities of the software and technology, then followed by experimental methods, with the desire to push and extend boundaries.

One commonality, however, between both methods, was the issue of constraint presented by the software I utilized, ARStudio. The two main constraints were: a) being limited to eight markers, and therefore, only eight augmented images that could be viewed within one project; b) the fact that only one marker at a time could reveal augmented imagery, rather than having multiple marker recognition and augmented imagery appearing simultaneously<sup>1</sup>. These constraints, however, formed a framework from which to begin working with the medium; I believe I was successful in developing creative scenarios around these parameters.

I attended a presentation at the Creativity and Cognition Conference 2007 in Washington, D.C. by Michael Century, an active proponent of research-based creation in the experimental arts since the 1980's. Century's paper, "Exact Imagination and Distributed Creativity: A Lesson from the History of Animation" (2007), discussed the

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<sup>1</sup> Since my body of work in AR has been developed, ARTag2 has been released by the NRC, replacing ARStudio. ARTag2 allows for multiple marker tracking and recognition resulting in more than one augmented image appearing at a time.



introduction of software as a creative medium for animation production at the National Film Board (NFB) of Canada during the 1960's and 70's. Century referred to the creative methods of animator Norman McLaren, commenting upon limitations as the starting point for visual conceptions. In his paper, Century quotes McLaren in expressing his creative credo as, "Making the very limitations of these mechanisms, when brought in touch with the theme, the growing point for visual ideas" (83). Throughout the paper Century discusses McLaren's Academy Award nominated animated film "Hunger / La Faim" (1973), which was created with the aid of a computer. The accomplishment of "Hunger" is discussed by Century "in matching an artist's vision to the still very intractable computer of the day ", commenting that although costs were promised to be saved by automating the intensive human labor of the artist creating the animation by hand, giving the "technical awkwardness" of the computer, "it could only be put to creative use by an artist willing to shape her vision to its mechanical constraints" (87).

Rather than beginning with content, then, I began with the medium itself, exploring the creative properties, starting with its constraints, from which creative applications and visions could emerge. I was introduced to McLaren's creative approach to working with the computer to create artistic work, noted in Century's paper, after having created the majority of my works in AR. However, given McLaren's pioneering use of software as a creative medium for animation production, I believe it is relevant to note my process as mirroring that of McLaren's, as beginning with the very limitations of the technology as the starting point for visual ideas. I, too, believed that the approach necessary to creatively engage with this medium was to be willing to shape my vision to the mechanical constraints of the (AR) software.

Another key aspect to my approach was to engage with the medium directly, which aligns with McLaren's perspective of "handling personally the mechanisms that do remain, in as intimate a way as a painter her painting, or a violinist his violin" (Century 83). In the section "Project Contribution", I referred earlier to Blair MacIntyre's viewpoint of designers as being most effective when working directly with a medium and it was important for me to be able to experiment with the medium on my own, and express my artistic vision by means of direct access to the medium, rather than working with a computer programmer. The example given by MacIntyre of a painter being able to hold the paintbrush oneself rather than directing an assistant as to where to apply paint on a canvas echoes McLaren's desire to work intimately with the medium and my own experiences in engaging directly with AR.

### **Introduction to Final AR Artworks Created**

Each of the final AR artworks will be discussed in further detail within the respective methods section (traditional marker-based tracking method, and experimental methods); however, I here wish to provide an overview of the AR projects which compose the final body of work produced, briefly introducing each artwork, how they evolved, and the method to which they belong. These works are discussed throughout this paper in the chronological order in which they were created, in attempt to trace and discuss the creative process and iterative nature of the works. It is important to note that as the multiple works created utilizing both traditional and experimental methods are considered to be a body of work contributing to the medium of AR.

My work in AR began with a series of miniature memory objects including an AR memory album, AR travelogue, AR postcard and AR memory box with petite slide-like

markers. These works explored the possibility of integrating cinema into tactile paper-based objects. AR generated moving images in the form of short digital video clips from my sojourns were presented atop paper objects, which the viewer could hold in the palm of their hands (See Figures 2-5, Appendix). I was greatly interested in the aspect of intimacy exhibited in the AR memory objects, both in their scale and tactility. I researched the art of paper engineering and book-making and created an AR Pop-up Dollhouse, which contained various AR markers to explore and discover (See Figures 6-7, Appendix). The viewer could hold and guide the web-camera through the miniature house (or view the experience using AR glasses), and reveal various AR imagery, such as fire flickering in the fireplace, and people knocking at the window.

Upon creating these works utilizing traditional marker-based tracking methods, I became interested in experimenting with alternative image generating methods and surfaces. I was intrigued by the database-like structure and storage and retrieval system of the AR markers and augmented images, however, I was frustrated by the constraint of having only one AR image appear at a time. My solution had previously been to focus the viewer's attention on one marker at a time, such as in the AR Memory Object series, in turning the pages of a book to view the next marker, and in the AR Pop-up Dollhouse, in having each marker a distinct component to explore one at a time throughout the environment. I was now interested in creating a surface that would enable multiple markers to appear within a single object or surface, without having to turn a page or redirect the web camera. I experimented with lenticular materials and created a single object that contained two markers, and thus two AR images (See Figures 8-11, Appendix). Lenticular AR combined both virtual and analog systems of image storage

and retrieval. The AR content in Lenticular AR was also activated and controlled by the viewer. Holding the object in their hands, the viewer was able to move back and forth between the AR imagery with a slight shift of hand.

Lastly, Hallucinatory AR *I*, and Hallucinatory AR *II*, were experiments which investigated the possibility of non-markers to generate AR imagery (See Figures 9-26). These projects evolved out of accidents, incidents in earlier experiments in which the AR software was mistaking non-marker imagery for AR markers and attempted to generate AR imagery. This confusion on part of the software resulted in unexpected and random flickering AR imagery. I decided to explore the creative and artistic possibilities of this effect further and experiment with non-traditional marker-based tracking. The process entailed a study of what types of non-marker images might generate such 'hallucinations' and a search for imagery which would evoke or call upon multiple AR images from the database.

## **SECTION B: BODY OF WORK / THEORETICAL DISCOURSE**

### **Overarching Theoretical Discourse and Themes Across Both Methods Utilized**

The relevant themes and theory pertinent to each individual AR artwork are discussed in detail in the respective methods section. I here would like to discuss the overarching themes and theoretical framework relevant to the final body of work, across both methods employed, particularly in regards to the technology and medium of AR and the effects produced.

The series of artworks I have created in AR extends across various media forms including photography, cinema, and digital technology. In attempting to position my work within a theoretical discourse across these multiple media, I first trace my work back to the history of the moving image, linking my projects to pre-cinematic devices. I have drawn inspiration from early animation techniques and optical illusions that create a simulation of images in motion, which predate cinema. The notions of simulation (to imitate the appearance of), and animation (to bring to life) are key terms to consider in my work, a point to which I will return. There is also a certain element of magic to my work, which too can be linked back to the era of early and pre-cinema and will be discussed. I would like to begin, however, at the point from which all of these ideas evolve. From AR Memory Objects of places once traveled, to a miniature dollhouse with AR objects to uncover, to then being able to pass forward and backwards through time with a slight shift of hand in Lenticular AR, and experiencing flickering oneiric imagery in Hallucinatory AR, all of these pieces possess one commonality: the absence of sound. There is no dialogue among the people in Lenticular AR, no noise from the crackling fire

AR marker. The unconsciousness is twofold: it is present in both the final animate imagery,



in the AR Pop-up Dollhouse, no sounds of nature in the places visited in the AR Memory Objects. The final renderings are all silent moving images.

The absence of sound may in part have been due to the constraints of the technology I was working with. Although sound could have later been added using other methods, leaving it out was a conscious decision. In reflecting upon this choice and the effect it has had on the work, my thoughts turn to experiments in early cinema and animations of moving images, which, too, were initially silent. In this sense, I align my work in AR closer to the history of early cinema as it pertained to animation and the sense of magic and illusion created, two themes I will return to discuss later.

I position my early work in AR, particularly the AR Memory Object series, and even Lenticular AR, as existing in a space in between photography and film. I choose to refer to the AR generated visualizations as “moving images”, not film or video, partly due to the absence of any accompanying audio, but also in reference to pre-cinematic devices. Coming to life on the paper surface of the handcrafted objects, these AR renderings are like quiet moving photographs, no longer embalmed or still, but revived and animate.

An uncanny quality pervades the act of viewing these moving images. In the article “Re-Newing Old Technologies” (2003), film scholar Thomas Gunning writes, “The specific effect of the uncanny comes from the flowering of a sense of unfamiliarity in the midst of the apparently familiar” (47). The seemingly ordinary and familiar items throughout my body of work, such as the AR Memory objects, come to possess an unreal and unnatural quality once the moving images appear on the paper surface, usurping the AR marker. The uncanniness is twofold: it is present in both the final animate imagery,

which is devoid of any 'natural' sound, and in the means of the technology by which the imagery comes to exist virtually, perhaps even magically. A newness comes to take over the familiarity of the tactile objects, now somehow made strange.

In his 1919 essay, "The Uncanny", Sigmund Freud discusses the uncanny as an instance when the familiar becomes unknown and frightening. Although I do not perceive my work in AR to be exactly "frightening", per se, I do believe that there is an initial startlement evoked in the viewer, perhaps even astonishment. This is followed by an uncertainty of how the images come to be and a questioning of the technology. In her book, "Death 24x a Second" (2006), Laura Mulvey comments upon computer-generated images creating a "technological uncanny", which she describes as "the sense of uncertainty and disorientation which has always accompanied a new technology that is not yet fully understood" (27).

Here I would like to introduce the notion of wonder as it pertains to new forms of technology, particularly AR, beginning with a link drawn from the uncanny. To do this, I'd like to follow Mulvey's discussion of the "technological uncanny" by inquiring what happens after a new technology becomes old, or "understood". Gunning asks, "Once understood, does technology ever recover something of its original strangeness?" (45). Gunning approaches this self-stated "dilemma" as a historian "searching for the novelty of old technology" (45). I am particularly interested in this idea in regards to my own work, as I draw direct inspiration from the wonder pre-cinematic devices instilled in me, and once did when first novel; I attempt to recreate that same wonderment with AR in my own work.

Gunning proposes that there are several ways to renew wonder at technology, to maintain this “strangeness” he describes. One method Gunning discusses is Russian Formalist Viktor Shklovsky’s technique of de-familiarization or “making it strange”, from the text “Art as Technique”, first published in 1917, and translated into English in 1965. Shklovsky writes, “If we start to examine the general laws of perception, we see that as perception becomes habitual, it becomes automatic” (276). Shklovsky illustrates this idea in providing the example of remembering the “sensations” of holding a pen or speaking a foreign language for the first time, and comparing this feeling after performing the same action for “the ten thousandth time” (276).

Gunning relates Shklovsky’s description of habituation and the resulting automatism to innovation sinking into a second nature, describing this phase as “the opposite of amazement” (44). Gunning discusses Shklovsky’s de-familiarization technique as “refashioning discourse away from the automatic so that the familiar becomes strange and can be re-discovered in its sensual specificity and vividness” (45). This shift away from habituation then creates the opportunity for a perceived wonderment and “amazement” to occur. Shklovsky writes, “Art removes objects from the automatism of perception”, proclaiming that art can regain and recover this “sensation”. He writes, “The technique of art is to make objects ‘unfamiliar’” (277).

Gunning observes, “For Shklovsky, de-familiarization deals with perception not knowledge” (45). Gunning draws the link with technology and knowledge commenting that he believes it is erroneous “to believe that we possess a full understanding of technology through a scientific explanation of how it works” (45). Shklovsky writes,

“The purpose of art is to impart the sensation of a thing as they are perceived and not as

they are known" (277). The condition of knowledge and its role in "de-familiarization" and regaining "sensation" raises intriguing questions in regards to technology. Do "scientific explanations" and that which is known then need to be abandoned in order to perceive amazement in technology, old and new? Shklovsky and Gunning's statements are interesting to consider against Mulvey's description of the "technological uncanny", where "the sense of uncertainty and disorientation" is inherent in a new technology which "is not yet fully understood" (27). Knowledge here can be linked back to a lack of the proper understanding of a new technology and how it functions, as well as to "uncertainty", which too results from the unknown. In Mulvey's description a 'sensation' occurs when there is an absence of knowledge. Mulvey interestingly also uses the word "sense", comparable to Shklovsky's repeated use of the term "sensation"; however, I do not believe it was Shklovsky's intent for art to "disorient" or to make the viewer necessarily "uncertain", but rather to heighten stimulus and a perception of form, which habituation can drain.

Within my work I see a connection to both Shklovsky's and Mulvey's discussions. Specific to Mulvey, there is a link with my work to the amazement or "strangeness", which stems from the viewer's lack of knowledge or 'familiarity' with the technology. In the case of Shklovsky, attention is anew in my work in relation to the "de-familiarization" of the form, both in the virtual moving images that appear atop the tactile paper-based surfaces, and in the absence of sound. Perhaps it is the lack of sound that enhances the "sensation"<sup>2</sup>, making the work "strange" and unfamiliar. To relate back to

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<sup>2</sup> I'd like to here make a further comment in regards to enhancing the 'sensation' and the absence of sound. During one of my AR demo presentations, a fellow graduate student made an interesting observation in regards to the absence of sound in my artworks. She

Shklovsky's earlier example of habituation, we have seen and heard video clips with accompanying audio endlessly, it is nothing new. This is not to say that it is groundbreaking to remove audio from video; however, coupled with the newness of the technology of AR, the absence of audio does create a moment of 'unfamiliarity' away from the automatic and habitual, that which we have come to expect and know.

What, then, counters knowledge in this process towards achieving defamiliarization and a sense of the uncanny? I'd like to propose it is an element of magic, quite opposite to rational, scientific knowledge. Towards the end of his discussion of the uncanny, Freud refers to magic. Freud writes, "The analysis of cases of the uncanny has led us back to the old *animistic* view of the universe, a view characterized by the idea that the world was peopled with human spirits ... by the omnipotence of thought and the magic that relied on it, by the attribution of carefully graded magical powers (*mana*) to alien persons and things" (147). Freud discusses how in the course of our individual development, we have gone through a phase which corresponds to the animistic phase in the development of "primitive peoples", noting that this phase "did not pass without leaving behind in us residual traces that can still make themselves felt" (147). Freud furthers that, "everything we now find 'uncanny' meets the criterion that it is linked with these remnants of animistic mental activity and prompts them to express themselves" (147). Freud later states, "An uncanny experience occurs either when infantile complexes which have been repressed are once more revived by some impression, or when more primitive beliefs which have been surmounted seem once more to be confirmed" (155).

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noted that typically one pays "closer attention to what is seen" in film when the sound is turned off or removed; there is a heightened awareness of the images, content, angles and shots. I'd like to suggest that perhaps with no sound present in these works, there is a greater level of sensation achieved of the augmented images presented.



Here Freud's mention of "primitive beliefs" is in reference to the after-life, magic, the supernatural and superstitious ideas, which he briefly touches upon in the essay.

Gunning too references Freud's mention of "primitive beliefs", suggesting that this term recalls "the discourse of wonder that marks the introduction of new technology, picturing them as magical creations and elemental beings" (47). An element of the fantastical exists here in what Gunning describes of Freud and the uncanny, far from rational knowledge. Gunning continues this discussion including mention of habituation, which he presumably does in reference to Shklovsky's technique of "de-familiarization":

If the uncanny as understood by Freud also harks back to childhood beliefs of in animism and the omnipotence of thoughts, the fact that many of us as children first encounter technology through the lens of such manufactured folktales, may in fact produce lasting impressions, preserved beneath a later learned rationality. In other words, new technologies evoke not only a short-lived wonder based on unfamiliarity which greater and constant exposure will overcome, but also a possibly less dramatic but more enduring sense of the uncanny, a feeling that they involve magical operations which greater familiarity or habituation might cover over, but not totally destroy. It crouches there beneath a rational cover, ready to spring out again. (47)

Here, then, the uncanny, magic, wonder, and habituation come full circle in respect to technology. Gunning cautions, though, that sensations of wonder and the uncanny are more likely to occur in some technologies more than others. He cites examples of communication, like the telephone, and representation, such as the photograph, as particularly subject to these responses; such "technologies of reproduction" are especially inductive of uncanny effects (47).

I would now like to draw an association with technologies of reproduction to the animate. At the beginning of this discussion I utilized the term "simulation" in regards to animation and early cinema, with animation creating a simulation or illusion of motion. A

simulation implies a reproduction, copy, or imitation. Simulation, then, can be perceived as a term embedded in the “technologies of reproduction”, particularly in the digital realm. The process of animation, in the general sense of the word, to animate, which also carries the meaning of instilling life, may be employed to enhance a simulation, to make it appear more ‘real’.

This brings me to another definition of the uncanny Freud explores, which pertains to the animate. In seeking to review situations and processes which can arouse a particularly strong and distinctive sense of the uncanny, Freud refers to psychiatrist Ernest Jentsch’s study, “On the Psychology of the Uncanny” (1906). Freud cites an example Jentsch singles out as an excellent case of the uncanny, “‘doubt as to whether an apparently animate object is really alive and, conversely, whether a lifeless object might not perhaps be inanimate’”(135). Jentsch refers to the uncanny impressions made upon humans by waxwork figures, constructed dolls and automata.

What role does simulation play here in Jentsch’s example? Is the process of animation or automation exhibited in the object questioned as being simulated, with the object actually being inanimate, yet given the appearance or illusion of a life-like quality? Another term to consider, and to add to this discussion, is verisimilitude, which is synonymous with realism and ‘lifelikeness’. What role does verisimilitude play in the uncanny in regards to Jentsch’s example, particularly as it relates to technologies of reproduction? Freud wrote that when confronted by the uncanny, “The whole thing is purely an affair of ‘reality-testing,’ a question of the material reality of the phenomena” (154). I’d like to relate this back to Jentsch and the query of the verity of the object’s status as animate or inanimate, whether it is “really alive”, or not.

In Jentsch's description there is "a doubt", of the actual animate or inanimate nature of an object. I'd like to extend this idea by postulating that this doubt queries what really lies beneath, what fuels the object giving it apparent life or lifelessness. To what degree does Freud's discussion of the uncanny and its ties to animism, as previously noted, pertain to Jentsch's example? Freud had stated, "everything we now find 'uncanny' meets the criterion that it is linked with these remnants of animistic mental activity"(147). What is it that 'fuels the object', giving it life, or not? Can it be attributed to the notion of an animistic view, a spiritual or magical power embodying the object? Is it the very question of this animism as magical that makes the object uncanny? Can we associate animism with the "technological uncanny"? What relationship does animism have to technology?

Animism is a term used in Human Computer Interaction (HCI) and interface design to ascribe human qualities to inanimate objects. In the paper, "Living in a Zoo – Bringing User Experiences with Technology to Life" (2004), researchers Katja Barbee et al. reflect on a user study conducted to learn about the values and experiences people associate with different kinds of domestic technologies. The researchers write, "The central feature of animism is its tendency to give both animate and inanimate objects human characteristics and abilities" (Barbee et al. 2). In the section entitled, "Thinking technology through animistic framework", Barbee et al. describe an animism exhibited when observing children's relationships to toys. They state, "electronic toys do not present their functionality in the same way as mechanical objects such as bicycles. Instead, children think of electronic toys as psychological machines that are 'sort of alive'" (2). Referring to Byron Reeves' and Clifford Nass' book, "The Media Equation:

How People Treat Computers, Television, and New Media Like Real People" (1996), the researchers note that, "Adults also subconsciously respond to and treat computers as they would treat human interaction partners"(2). They discuss how people's perceptions of information technology have features that can be related to animism. The researchers compare living with technology that is usable, but, still for most, not entirely comprehensible to "the limited understanding of natural forces and processes of pre-modern times" (2). The researchers note, "One common emotional response to such indeterminacy is to construct an explanation involving supernatural influence"(2). We can here link the findings of Barbee et al. to Freud and his use of the term "primitive beliefs", as well as return to Gunning's earlier discussion of a novel technology being perceived as a "magical creation". A comment we can add to this comes from Mulvey who writes, "A technological novelty gives rise to a technological uncanny, in a collision between science and the supernatural" (43).

To further the discussion in regards to the animate/inanimate and technology we can look to French filmmaker and magician George Melies (1861-1938). Melies became famous for the "trick-film", which Gunning, in the article, "Primitive Cinema" (1989), describes as continuing a "tradition of visual illusions"(3).<sup>3</sup> Melies was first a stage magician before being introduced to cinema at a preview of the Lumiere brothers' invention, where he is said to have exclaimed, "That's for me, what a great trick" (Gunning, Fugitive 62). Melies' trick-films employed a stop-motion and substitution technique, which was later to be revealed as enhanced by the splicing of film. Melies described his process as a stopping of the camera at a predetermined point, rearranging

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<sup>3</sup> Gunning is most likely referring to the "visual illusions" of pre-cinematic devices such as the magic lantern, stereoscope, and optical illusions he mentions earlier in the article.



actors or props, and then resuming filming. Gunning notes that upon examination of the actual prints of Melies' films, this stop-motion technique was in fact revised through the process of splicing, which we normally associate with editing. In the book "Marvelous Melies" (1974), author Paul Hammond describes the effects achieved in Melies' films:

An object can be transformed, either instantaneously or gradually, into another object; an object can grow or diminish before our eyes, while the rest of the image remains a constant size; an object, usually human, can disintegrate into parts, then these can assume a life of their own; an inanimate object can begin to move and an animate one defy the laws of gravity; an object appear or disappear instantaneously or gradually. (89)

Here Hammond speaks to the qualities of Melies' work that play with the status of the inanimate and animate, which can be related back to Jentsch's example of the uncanny. Mulvey writes, "Just as the cinema animated the inanimate photograph, so Melies used the cinema machine to give life to lifeless representations of the human figure" (47). I'd like to pause and reflect on Mulvey's statement of cinema animating the inanimate photograph<sup>4</sup>. Mulvey is here playing on both meanings of the verb to animate, as a technique employed to create a moving image, and "to give life". It is technology, "the cinema machine", that Mulvey describes which instills "life" into inanimate forms. Here I think of Mulvey's statement in regards to my work. At the beginning of this discussion I referred to the AR images in my work as "quiet moving photographs" that were no longer static, or "embalmed", but now revived and animate.

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<sup>4</sup> Before cinema, photography too was seen to have an uncanny quality, serving as a 're-animation' of life itself, a mimetic representation. Gunning writes, "Still photography originally generated grave suspicion due to its seeming uncanny resemblance to its subject and the apparently automatic nature of its production. The new technology allowed a re-animation of the ontological instability of all mimetic representation" (Gunning, Re-Newing 49).



How, then, does the animate and inanimate relate to the AR technology I employ?

I often feel like a magician when presenting demos of my AR work live. AR, too, like trick-films, and pre-cinematic devices, can be considered a visual illusion. As in Melies films, I also present a trick of substitution. Although there is no stop-motion, or splicing involved, the spirit of these techniques is present when the seemingly inanimate black and white square AR marker becomes replaced by animate imagery. This is the 'trick' I employ to 'give life', or *animate*, apparently inanimate objects. This ranges from moving images in the AR Memory Objects and throughout the AR Pop-up Dollhouse, to Hallucinatory AR *I* and *II*, and the images which are 'magically' conjured. The act of AR present in my work can be simplified to a swap trick: once the marker is 'seen' by the camera and identified by the software, the software then replaces the marker with the augmented image. A virtual splicing takes place between reality, atop the tactile surface, and the virtual imagery, all in an act of animation<sup>5</sup>, in both meanings of the term. The novelty of the technology creates the sense of a "magical creation", to use Gunning's words, a situation in which the uncanny arises.

There is one last relation to the uncanny which I would like to draw with my body of work in AR, and that is the hidden or secretive. In his discussion of the uncanny, translated from the German word "unheimlich"<sup>6</sup>, Freud looks to various languages for

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<sup>5</sup> Lenticular AR is a particularly special case here in regards to animation as there is both an analog and virtual/digital animation occurring. The analog animation is reliant upon the surface material of the lenticular lenses, with the virtual/digital animation based upon the AR software and marker recognition. Both forms of animation coexist to create the work

<sup>6</sup> A further connection I would briefly like to note is another translation of the word "unheimlich" that Freud draws upon, which is "unhomelike". Here, my thoughts turn to the AR Pop-up Dollhouse project, which I also noted in regards to the uncanny and animism.

their meanings of the term. One translation describes the uncanny as “concealed, kept hidden, so that others do not get to know of it or about it and it is hidden from them”, as well as “what was hidden” and “things which have been kept secret” (Freud 129). One translation, offered by Friedrich Schelling is bolded in Freud’s essay and reads, “Uncanny is what one calls everything that was meant to remain secret and hidden and has come into the open” (132). Freud writes, “our attention is seized by Schelling’s remark, which says something quite new – something we certainly did not expect ... that the term ‘uncanny’ (unheimlich) applies to everything that was intended to remain secret, hidden away, and has come into the open” (132). Freud later goes on to discuss the uncanny “as nothing new or strange, but something that was long familiar to the psyche and was estranged from it only by being repressed” (148). Freud notes that the link with repression illuminates Schelling’s definition as that which should have remained hidden, now coming into view.

AR, too, has a secretive quality, the hidden image only visible through designated receptacles. To the naked eye, the AR marker is a black and white patterned square, which only comes to light and “into the open” when activated by the technology. AR in this sense makes the invisible visible, but only to those who may access the technology through the appropriate viewing mechanism.

## **SECTION C: TRADITIONAL MARKER-BASED TRACKING METHOD**

### **Introduction to AR Software Utilized in Traditional Marker-Based Tracking**

Before working with ARStudio, which I used to produce my final body of work, I experimented with DART, working through the various simple exercises and support documentation included in the download. In the end, however, I did not find DART to best suit my creative needs. I have previously worked with Macromedia Director, the environment in which DART works, and also have experience coding in Lingo. However, I found the authoring environment to be too cumbersome to experiment with AR, and at times confusing. Although the timeline feature in Director could be useful in creating interactive elements, I did not find it of particular use in the AR work I was trying to create. Overall, I felt creatively stunted in the DART environment. I didn't feel that DART provided clear enough examples of what was possible in this medium, or the flexibility to be able to experiment and explore AR. This said, although I did not find DART to be suited to my individual needs, DART has been used to create successful AR projects. I commend its creators' intentions to develop an AR tool allowing non-programmers and designers to engage directly with the medium. It is my opinion that DART may be better suited to applications where content drives the AR project and final outcome, rather than an intention such as mine, which was to start with the medium first and see what could evolve through a process of experimentation.

Marker tracking was another key factor in choosing between AR software applications to work with. In DART I disliked how multiple markers were required to track a single marker. In order to create one augmented image appear, six markers were necessary. Hence, all six markers would typically appear in the final augmented output,

with only one of the markers having an AR image layered atop it. Using multiple markers did improve tracking accuracy, however, I found the multiple markers to be distracting and uninspiring. The software I used to develop my AR artworks, ARStudio, required only a single marker for tracking, with the marker completely disappearing from view when the augmented imagery appeared. I was drawn to how well the marker tracked and its ability to maintain angles when the marker was viewed from various directions. In both DART and ARStudio, marker tracking was sensitive to low-light conditions, however, I found the tracking in ARStudio to be slightly more robust in various lighting situations.

I first came to work with ARStudio upon downloading a demo from the NRC of Canada. The demo included examples of augmented imagery associated with each marker including various three-dimensional animation models, a .jpg photo file, and an .avi video file. The video file was the last of the augmented imagery, included as black and white rolling film credits, listing the names of the individuals who worked on ARStudio. Although the video file consisted of basic text, with no other visuals or even colour, I was immediately inspired by the opportunities for cinema in AR. Prior to this demo, I had only seen 3D animation models utilized in AR; I became extremely excited by the possibility for incorporating video files. The ARStudio demo was successful in showcasing various types of media the software could integrate: animation models, graphics, and video files were each shown to work with the markers. Being able to view these multiple scenarios was of great use and inspiration in thinking about and imagining the creative possibilities for this medium.

The next step was to attempt to understand how the software functioned. Being only a demo, unlike DART, there was no interface to create the applications within ARStudio, simply the code that operated the demo. I began to experiment with the files that were included in the demo, looking at the code and trying to alter it. Upon close examination, I realized that each marker had a pattern file associated with it, containing the information about that specific marker and the augmented imagery associated with it. Each pattern file included the mathematical coordinates that composed the structure of the marker, which was how the camera came to identify the marker. There was then a file path traced to the augmented imagery, corresponding with each marker, with a name and file type identified. This was the key for me to work with this demo and to be able to experiment with my own content to better understand the functionalities of the medium and its potential creative properties.

This entailed a long process of trial and error, for if there was one small inaccuracy, none of the markers would function at all, even if the erroneous code was unrelated to the specific marker I was working with. Upon my first attempt to work with video files, I realized that the software was only compatible with .avi files, not QuickTime .mov files or .mpg files. This required converting my existing video files to .avi formats. Once I had produced a test .avi file, and created the proper path and folder structure to link to in the code from the pattern file, I was able to test the demo with my own video AR content. However, when I ran the now altered demo, the video file became a multiplied image; within the frame of the marker, the video was repeated in a grid-like format, composed of numerous windows of the same video. I returned to analyze the properties of the .avi file that was included in the demo. My hypothesis was that this



strange multiplied image was the result of differing proportions of the video in comparison to the square marker and the software trying to adjust the size of the video to match that of the marker. I observed that the .avi file included with the demo was 256 pixels by 256 pixels. In addition to converting my video's file format, I also then resized the video frame to 256 pixels by 256 pixels. This resulted in a successful video image appearing in AR, atop the marker.

Once I had experimented with coding the various media files, and became comfortable with the properties and parameters of the AR imagery I could integrate, their file types, formats, and dimensions, I was able to rapidly prototype various ideas in an iterative process. The basis of these constraints assisted to create content, as discussed earlier. In approaching this project and working with AR as a new medium, I believed it was important to first understand the structure and capabilities, then to create content, rather than commencing with content. This approach also ensured the suitability of the form, or medium, to the content, rather than producing content that might have been better suited to another medium.

### **Project 1: AR Memory Objects**

#### **Process**

My work in AR began with a series of paper-based memory objects that presented digital video footage from my travels. My interest in creating these works was due in part to a desire to capture 'live' moments from my sojourns that were beyond still photographs, which would aid to temporarily transport me back to these foreign locales to relive those instants. These moving images aided me to recollect my memories by enabling me to rearticulate a past vision of a particular location: once again seeing how

the waves crashed, how the wind blew, how my body moved in a space which I no longer have physical access to. I found that unlike the digital photographs that I took and would eventually print and place in an album, these moving images (MPEG format) most often remained archived on disc or on my computer never to be experienced again. I desired to create a tactile object where I could hold and view these 'live' moments again, alongside my still photographs, offering an opportunity to move through the still images, extending into and beyond their virtual viewing space.

I created a series of small hand-held AR objects including a palm-sized memory album, a set of paper slides cased in a petite box, a postcard, and a travelogue, which alongside video-clips, included actual objects from my journeys in addition to hand-written stories accompanying each clip (see Figures 2-5, Appendix). None of the moving images I chose to include featured people; they were all pans of landscapes of the sites I visited. I viewed this as an opportunity to document the physical places I visited, as a form of souvenir that would allow me to visually revisit (virtually) and enter that space again via a moving image that captured my field of vision in a horizontal pan. Without other people in the footage, this aided to create an intimate, uninterrupted space, as though that particular moment was for me, undisturbed by anyone else, a private memory, between that place and I. My works further exhibit a level of intimacy in their miniature scale; most of my projects fit in the palm of the viewer's hand.

### **Project Themes and Theoretical Discussion:**

#### **Theme: The Stereoscope and Virtual Voyages**

The AR Memory Object series recalls early Victorian stereographic cards. When first introduced, the subject matter of stereoscopic photographs was the outside world,

including such sites as monuments, landscapes and exotic locales. Sets of stereographic cards complete with maps and guidebooks of distant lands were marketed as “Travel Systems” and “Tours of the World” by major stereoscope companies like Underwood & Underwood, and the Keystone View Company (Huhtamo, Armchair 1). Predating cinema and television, stereoscopes offered the viewer the luxury of a virtual voyage around the globe, being transported to spectacular sites without leaving the comforts of home. These images would spring to life in three-dimension, popping off of the page. Although there was no actual live-action or motion in these early stereographic images, they share with the AR Memory Objects the characteristics of presenting (or creating an illusion of) depth on the page with “real” images, as though one was peering through a window into an outside world. The AR Memory Objects, featuring images of Australia’s landscapes and iconic tourist sites, allow the viewer to be an ‘armchair traveler’, as viewers of stereoscopic imagery once were. The AR Memory Objects series also shares a common level of intimacy with the stereoscope as the design permitted one viewer at a time to view these virtual images, the same way in which these AR objects are intended to be experienced.

### **Theme: Possessing the Miniature**

As with stereographic images, the capability of holding the moving images of the AR Memory Objects in one’s hand can also be interpreted as the power to possess these images and ultimately the sites viewed. In the article “Stereography and the Standardization of Vision” (1994), Jib Fowles writes, “Stereography additionally granted its viewers a form of omnipotence. Holding a stereographic card first by hand and then in stereoscope, they could in a most elemental way possess it. It was totally under their

control. The sight did not tower over them; they towered over it" (91). It is important to note the significance of scale and the power to "tower over" the sites viewed through the stereoscope, which is also relevant to the miniature size of the moving images in the AR Memory Objects. In "The Poetics of Space" (1994), Bachelard writes, "The cleverer I am at miniaturizing the world, the better I possess it. But in doing this it must be understood that values become condensed and enriched in miniature" (150). Although Bachelard was not writing about stereography, associations with Fowles' statements can be made in respect to "miniaturizing the world" and better possessing, particularly as these stereographic "Tours of the World" were bought and sold as commodities. In regards to the AR Memory Objects, it can be interpreted that by miniaturizing the world of boundless moments and memories, perhaps these images can be reclaimed and remembered, and therefore better possessed.

### **Theme: The Miniature and Compression**

Bachelard makes a particularly interesting comment on the values of the miniature as "condensed and enriched", which is important to consider in respect to the size and scale of the moving images of the AR Memory Objects, as well as stereographic images. Both image types aim to compact, thereby creating a dense picture of the world by means of a miniaturized synopsis. In this process of compression, an intensity is gained, which adds to and enriches the experience. There are two types of compression that occur in the AR Memory Objects: a reduction in size or spatial dimensions of the objects originally viewed; and a technical compression of data, in the form of bytes and file size. In "Nostalgia for a Digital Object" (2003), Vivian Sobchack comments upon the values attained as a result of the technical limitations of data storage in regards to the

'little movies' in QuickTime (QT), or as she prefers to call them "QT memory boxes". "Objectively, the miniature is a compression of data in space, but phenomenologically and poetically, compression and condensation *intensify* the experience and value of the data, making it something rare and precious, something spatially intensified and temporally condensed that is 'vast in its way'" (Sobchack 70). This vastness can be thought of in regards to the enriched values of the miniature Bachelard writes of, as well as the vastness of the sites and landscapes offered in the stereographic cards and the AR Memory Objects. In addition to the sense of 'vastness' provided by the technology in both cases, there is also a feeling of vastness in regards to the images continuing beyond the frame and vantage point of the viewer, extending off of the page into a limitless space. The AR Memory Objects' moving images are also "temporally condensed", only a few seconds in length, which adds to the "rare and precious" qualities of these 'little movies'.

#### **Theme: Secretive Containers and Database Storage**

Sobchack draws comparisons between QT movies and the work of American artist Joseph Cornell. "The miniature memory boxes of Cornell and QT, in framing and effect are 'reliquaries' – preserving, as it were, precious remnants and souvenirs that gain additional poetic force in that they are 'under glass'" (Sobchack 71). Not exactly "under glass", although the stereographic images and AR moving images are under the glass and lenses of the stereoscope and AR glasses, both types of images are preserved and captured as treasured artifacts and souvenirs of a time past. Sobchack continues and cites Bachelard, noting that a "'valorization of the contents' can also emerge through a 'valorization of the container'" (71). The moving images of the AR Memory Objects can



be thought of as “precious remnants and souvenirs” which gain “additional poetic force” in their specialized ‘secret’ containers. Encapsulated in an AR marker, the images are hidden from the naked eye, only to be revealed by means of a unique viewing device (special glasses or a screen).<sup>7</sup> In this respect, these moving images become privileged images, which are “valorized” by their “container” and required means of viewing. This thinking too can be applied to stereographic images, which were comprised of two photographs, taken at distances slightly apart, with the true image only revealed through the looking glass of the stereoscope.

In discussing the secretive as it pertains to the miniature, Sobchack presents an excerpt from Susan Stewart’s book “On Longing: Narratives of the Miniature, the Gigantic, the Souvenir, the Collection” (1993). Referring back to Stewart’s original text, the full quotation reads, “That the world of things can open itself to reveal a secret life – indeed, to reveal a set of actions and hence a narrativity and history outside the given field of perception – is a constant daydream that the miniature presents” (54).<sup>8</sup> Sobchack comments that the miniature, then, is always “secretive” to some degree, “pointing to hidden dimensions and unseen narratives” (70). The images of the stereoscope and AR Memory Objects too disclose such “hidden dimensions”, not only in their secretive and “valorized containers”, but also in the daydream their “vastness” presents: of an unseen world beyond the frame (as previously discussed), one that the viewer can imagine and attempt to fill in. The nature of AR as revelatory and secretive also enhances the private

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<sup>7</sup> The screen is noted as a possible viewing device, however, ideally the AR Memory Objects would function using AR glasses so one could look directly at the page and see the moving image appear before their eyes.

<sup>8</sup> Stewart’s quote is interesting to consider in regards to my earlier discussion of the uncanny as it pertains to AR and the translation of “unheimlich” in Freud’s essay as secretive and hidden.

and personal characteristics of the AR Memory Objects – of memories presented, and of those not seen.

Sobchack writes, “Like Cornell’s work with its slots, drawers, and compartments meant to contain and control the materials of overwhelming experience, QT memory boxes draw us inward into an ever-extensible reverie” (71). Although not contained within a box like Cornell’s relics, the AR Memory Objects use the pages of a book and small box to organize and file memories. This also recalls filing cabinets that existed for stereographic images, which Erkki Huhtamo refers to as pieces of “database furniture” (Huhtamo, *Origins* 12). The AR Memory Objects can also be thought of as a database of sorts. The information for the moving images that correspond to respective markers is stored away in code, in files on a computer, which, when called upon, processes a translation and the images appear. This database structure, however, is invisible, and even secretive, to the viewer, adding to the transparency of mediation, and ultimately, a more convincing, and presumably more “real” experience. Pulling back the curtain and revealing the ‘wizard of oz’ coding that powers these moving images could prove “overwhelming” to the viewer and destroy the illusion and magic of the technology. The concept of the database as a means “to contain and control the materials of overwhelming experience” is an interesting one to consider, not only in respect to containing the nuts and bolts of the technology, but also in regards to human memory.

## **Project 2: AR Pop-Up Dollhouse**

### **Process**

Although the primary subject matter of my initial explorations in AR were panoramic landscapes and vistas from my travel expeditions, the work which followed

focused on building miniature fictional environments, including a hand-sized folding pop-up paper dollhouse. The dollhouse integrated markers throughout the constructed environment which were replaced with short video clips that appeared on the screen when a hand-held camera was pointed at the markers (See Figures 6-7, Appendix). This included such miniature objects as a television screen, a fireplace, a window that opened and closed (offering a viewpoint outside of the house), a 3-D stereographic image book (a pun on AR's connection to the stereoscope), and a hidden element (a rat) that appeared from underneath a rug when a paper lever was pulled. This work was inspired by my love for children's pop-up books and the magic and wonderment such (analog) devices can create.

All of the video files that appeared in the dollhouse project (with the exception of one clip to be further discussed) were stock footage, unlike the video clips I captured in the AR Memory Object series, which embodied a personal and private quality. The stock footage utilized was 'slick' and 'polished', almost machine-like in its idealized perfection, which helped to uphold the illusion and spectacle of the dollhouse, whereas the videos I shot and featured in the AR Memory Objects had a certain roughness and a human quality in the jerking movements and pans, evoking a more personal and intimate experience. Although the AR Memory Object and AR Pop-up Dollhouse were both hand-crafted, the dollhouse was built and designed to be primarily illusionistic (using such tools as Photoshop), while the memory objects featured personalized details to highlight the trace of the human hand. The dollhouse was meticulously created to scale by carefully resizing and digitally manipulating found photographs of objects (often taken from furniture catalogues on the Internet) to build a realistic looking environment. (In

fact, during the Film Studies Association of Canada annual conference while the AR Pop-up Dollhouse was projected onto a wall as a large image, a viewer had asked, “Where is that house?” not knowing that the miniature dollhouse was what was being displayed, rather believing that this was an image of an actual, or ‘real’ house.

## **Project Themes and Theoretical Discussion**

### **Theme: Fractured Illusionism**

The polished appearance of both the digitally manipulated photographic elements and the video stock footage utilized in the dollhouse recall Stewart’s description of dollhouses in “On Longing” as presenting “the illusion of a perfectly complete and hermetic world” (62). This can be said for the most part about the AR Pop-up Dollhouse project, however, there are a few instances in which the perfection and hermeticism is temporarily fractured. The first instance is in the case of the one exception to the sleek stock video footage used in the dollhouse, which was a home video of a pet rat posted on YouTube.com. The marker on which this video clip appeared was hidden beneath a rug in the second room of the dollhouse, which could be seen by pulling a paper tab to reveal the concealed image. Another case in which the hermeticism was ruptured was unintentional and unpredictable, yet welcomed; this was due to momentary glitches in the marker-based tracking system when non-marker images were mistaken by the software, hence substituting an augmented image where one was not programmed to appear. Such examples included a video clip of fire (intended for the fireplace) coming from the bedroom window rather than the programmed image of a friendly pair of young people knocking at the window pane, as well as the pattern of the rug under the bed (an actual photo, not marker) being mistakenly interpreted by the software as a marker, to which a

video clip of fire also appeared coming out from under the bed. (These examples later gave way to various experiments resulting in the artworks *Hallucinatory AR I* and *II*, which are later discussed in the experimental methods section.)

### **Theme: Issues of Scale**

Stewart continues the discussion of the dollhouse in the chapter “The Gigantic” in respect to the topic of the miniature in which she writes, “In approaching the miniature, our bodies erupt into a confusion of before-unrealized surfaces. We are able to hold the miniature object within our hand, but our hand is no longer in proportion with its world; instead our hand becomes a form of undifferentiated landscape, the body a kind of background” (70). In fact, it was the sight of the disproportionate hand invading the dollhouse to interact with the elements, as shown in the projected image at the Film Studies Association of Canada conference, which served to shatter the illusion for the viewer who believed it to be a “real” house. Stewart continues, “Once the miniature world is self-enclosed, as in the case of the dollhouse, we can only stand outside, looking in, experiencing a type of tragic distance” (71). The dollhouse project can be seen as exhibiting a cold distance which limits the viewer as an outsider “looking in” at an artificial and idealized space that in fact exists only virtually.



## **SECTION D: EXPERIMENTAL METHODS**

### **Introduction to Process Utilizing Experimental Methods**

Although the same AR software was utilized to produce the artworks in this section, the approach was inverted. I now relied on the material or the non-marker image to lead, and in a sense author and define the work. The content was selected appropriate to the form of the AR object and the means by which the AR imagery came to exist. This concept is discussed further in each of the AR artworks below.

### **Project 3: Lenticular AR**

#### **Process**

My intent was to create tactile objects that could store and display multiple moving AR images, combining both analog and digital modes of memory. I have always been mesmerized by the technology embedded in lenticulars and their ability to contain and reveal multiple images with a slight shift of hand. I created an AR marker contained within a lenticular lens that presented two separate marker patterns (See Figures 8-11, Appendix). Each of these patterns reveals a different moving AR image when the lenticular object is slightly tilted. The end result is a layered form of a futuristic moving image, one which comes to exist via an analog mode of animation.

This object was produced at the lenticular workstation in the Guerilla Studio at the SIGGRAPH 2006 Conference in Boston, Massachusetts. Participants could bring two photographs or graphics to the workstation to create a simple lenticular animation. The two images were interlaced on a computer using lenticular-based software to create one single image. When the lenticular lens surface was affixed atop the interlaced image, the lenses would achieve the effect of being able to reveal two different images when the

object was viewed from different angles. This created the illusion of motion and animation when the lenticular object was tilted back and forth. I viewed this as an opportunity to experiment with AR markers. Rather than using two photographs, I had a lenticular object created from two markers. The Lenticular AR artwork is interesting to consider in regards to pre-cinematic devices in that it embodies early principles of animation and optical illusion, married with the virtual in AR.

### **Theme: The Passage of Time**

I have experimented with various applications for Lenticular AR, one of which explores the ability to display memories over time from past to present, combining both archival footage with contemporary moving images. This technique may be used to show growth over time, or various stages of one's life memories. One Lenticular AR prototype I created first displays a black and white film clip of two children playing and shyly kissing each other on the cheek; the second marker reveals a video clip<sup>9</sup> of the two children now grown-up playfully behaving in the same manner as they once did, as seen in the previous moving image. Lenticular AR may be used to display a before and after of sorts. The viewer can 'flip' between the two moving images in the same hand-held object, mid-clip, reverting between the two, crossing over time with a slight hand gesture. Another prototype demonstrates the ability to change the direction of the moving image, between forward and reverse, when the hand-held lenticular object is slightly shifted.

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<sup>9</sup> I'd like to draw attention here to how I first make mention of "film clip" then "video clip" in this example of Lenticular AR. I am here implying that Lenticular AR can also be used to show the progress of time over media and the history of cinema. Archival film footage can be unified with digital video in a single object.

## **Theme: A Dual Memory System, Analog and Digital**

I am particularly interested in the dual memory of the physical object and virtual imagery in Lenticular AR. Although the augmented image is stored digitally within the software, activated upon recognition of the AR marker by the software, the lenticular lens also contains an analog based memory system to store and reveal the two different markers with a physical tilting gesture. Each technology, AR and lenticular, presents an architecture which serves as a memory container with the final image only coming into full-view upon activation by the user. The completed images otherwise remain hidden from the viewer; the AR digital image appearing just as a square marker to the human eye without the software, and the lenticular analog image only a sole static still, unanimated. Although the AR image output is reliant on the software to translate and produce, the AR markers are initiated by the physical maneuvering of the lenticular lens by the viewer. This same gesturing is used to navigate between the final imagery, back and forth between the AR moving images. Both analog and digital methods must work together and coexist to bear lenticular-based AR. The direction of my future work looks to combine these two methods, utilizing both to create a final output where the digital and analog coalesce.

### **Project 4: Hallucinatory AR I**

#### **Process**

Unlike traditional marker-based tracking where augmented imagery was pre-programmed and assigned to various markers, the artwork *Hallucinatory AR I*, applied an experimental method using non-marker imagery to achieve spontaneous AR effects (See Figures 9-24, Appendix). As previously noted, the concept for *Hallucinatory AR I*

evolved from a series of visual accidents when the AR software I was utilizing temporarily encountered technological glitches; non-marker images were being misinterpreted by the software for markers. This resulted in flashes of imagery being activated by non-markers, bringing forth temporary instances of distorted (flipped, stretched, skewed and flickering) AR imagery; the effect was mesmerizing and magical. One significant instance of this occurred while a web-camera used in conjunction with AR software was directed at the black and white windowpanes of a small paper house I had constructed. Video of fire emerged from the windows, as though the house was burning; the windows had been confused by the software to be a marker. In another occurrence, the same image of fire was conjured by a photograph of a patterned rug positioned underneath a bed in the AR Pop-up Dollhouse I created. These events sparked a curiosity to explore what types of non-marker images might evoke such AR 'hallucinations'.

The process began with an attempt to identify non-marker imagery which would evoke AR imagery. In experimenting with various non-marker images, the image of fire reappeared on several different occasions. Hallucinatory AR imagery seemed to emerge from high contrast images, which were predominantly black in colour and framed in a square or rectangular shape (A sampling from non-marker image testing is included in Figure 15, Appendix). In each case, however, it was only the image of fire appearing; the software appeared to only be mistaking one marker file and therefore the imagery associated with that file. The endless testing of non-marker images that were successful always only resulted in the image of fire and no others (from a possibility of eight different images stored in the software).

My goal was to determine if other imagery could appear, or if it was only the one marker the software was mistaking. This in part was inspired by Lenticular AR and the possibility for multiple images contained in a single object. I attempted to narrow my search to find a non-marker image which would yield more than one AR image. In addition to high-contrast images framed by a square border, images containing geometrical patterns with areas of solid black seemed to work best. This criteria lead to testing various images including black and white mosaics, quilts, and stained glass window patterns. Upon searching through multiple imagery, one image emerged which proved to be quite extraordinary. This image, of a cathedral stained glass window, was able to evoke four different AR images, the only case in which multiple images appeared, in addition to the fire image. Upon close examination of the image, focusing in and out with the web camera, a face began to emerge in the black and white pattern (See Figures 16-17, Appendix). A fantastical image of a man was encountered in the black and white pattern. Interestingly, it was when the image was blurred into this face using the web camera that the AR hallucinatory imagery worked best, rapidly multiplying and appearing more prominently. Although numerous attempts were made with similar images, no other such instances occurred; this image appeared to be unique.

The AR images that were generated from this particular non-marker image were analyzed and the markers with which these images were linked to in the software were identified. The markers the software had mistaken were compared to the non-marker image that was inducing these visions (See Figure 18, Appendix). Similarities existed in that two of the markers resembled faces composed of geometric shapes. It was deduced, then, that the face which appeared in the non-marker image was being mistaken for these



markers by the software, thereby creating hallucinatory images. The other two markers, however, were composed of only squares and drew no apparent relation to the non-marker image.

In arriving at a perceived explanation and connection between two of the four markers and the non-marker image, this hypothesis was further explored by testing high contrast images that also resembled faces, contained in square-like borders. Upon testing several images, only two were successful, both being masks (See Figures 19-20, Appendix). These non-marker images, however, were only able to evoke one additional image to the fire. This concluded the testing of non-marker images, being satisfied with the result of finding one non-marker image that was able to trigger multiple AR images.

My efforts now turned to being able to apply the knowledge gained. Having identified which markers were being associated with the imagery conjured, I could now replace this imagery in the software. The challenge rested in the choice of what types of imagery to curate: what imagery would be best suited to this hallucinatory and dream-like form? Possibilities included imagery of apparitions and mystical forms. It should also be noted that during testing, the AR imagery was in full-colour, which made it easy to differentiate and interpret the images as disparate parts. Had the images been black and white, or like in colour, the effect of a single narrative or story might have been achieved, perhaps resulting in a more cohesive piece. This may also have been true had the imagery contained like content, or other similarities.

One of the images which appeared over the 'face' of the non-marker image during initial testing was that of water emerging from a geological blowhole. This image was well positioned atop the face in the non-marker image, appearing as though the face was

exploding and emitting a large mist. In searching through endless image options, I looked for imagery in like form and shape, in an attempt to create a collage-like set of visuals. As the sequence or duration of the imagery could not be predetermined, the goal was to identify imagery that possessed similarities, through which the possibility for synchronization existed. The final selected images (See Figures 21-24, Appendix) resulted in an elapsed-time sequence of a mushroom growing (the shape appearing similar to that of the blowhole), a mushroom cloud (referencing the growing mushroom), and a series of moving clouds (resembling both the mushroom cloud and the shape of the spurting water and mist from the blowhole).

## **Project Themes and Theoretical Discussion**

### **Theme: Dreaming and Hypnogogia**

I found these hallucinatory AR visions to be reminiscent of dream images in their temporal appearance and seemingly random imagery mystically appearing. I began to think of these fleeting and oneiric images in relation to hypnogogia and hypnagogic hallucinations occurring at the onset of sleep, when the dreaming mind and waking mind intertwine. In "Fire in the Brain: Clinical Tales of Hallucination" (1993), Ronald K. Siegel writes, "Hypnagogic images are the germinal stuff of dreams, and they usually begin with flashes of light. Often, an illuminated circle, lozenge, or other generally round form appears to come nearer and nearer, swelling to gigantic size" (109). The characterization of such images commencing with "flashes of light" recalls the means by which these AR hallucinations first occurred, as detailed in the initial accounts above, with 'flashes' of fire. The images were unstable, growing and decreasing in size, in an abrupt jarring motion, flickering in and out of existence.

Danish philosopher Jurij Moskvitin recounts his experiences in observing hypnagogia in "Essay on the Origin of Thought" (1974), describing hypnagogia as "states of mind when consciousness is kept somewhere halfway between the waking state and dream" (51). The action of these AR hallucinations coming into being can be thought of as a moment in between reality and a dream world, an instance of "surreality". In the "First Manifesto of Surrealism" (1924) Andre Breton wrote, "I believe in the future resolution of these two states, dream and reality, which are seemingly so contradictory, into a kind of absolute reality, a *surreality* if one may so speak" (14). Here Breton uses the French word "sur", meaning on or above, to imply a higher order of reality, a "surreality". The medium of AR may be thought of as a meeting of the real and the unreal, in the presentation of virtual imagery atop a physical or "real" world. What is experienced in the state of hallucinatory AR, however, may be perceived as a dream, or a nightmare, enacted by the software, temporarily transferred and escaping into reality.

### **Theme: Intrusions and Chance Encounters**

In "What is the Mechanism of Collage?" (1936), artist Max Ernst writes:

One rainy day in 1919, finding myself on a village on the Rhine, I was struck by the obsession which held under my gaze the pages of an illustrated catalogue showing objects designed for anthropologic, microscopic, psychologic, mineralogic, and paleontologic demonstration. There I found brought together elements of figuration so remote that the sheer absurdity of that collection provoked a sudden intensification of the visionary faculties in me and brought forth an illusive succession of contradictory images, double, triple, and multiple images, piling up on each other with the persistence and rapidity which are particular to love memories and visions of half-sleep. (427)

Of particular interest to my work in exploring and experimenting with hallucinatory AR was Ernst's description of an "illusive succession of contradictory images" that were "brought forth" (as though independent of the artist), rapidly

multiplying and “piling up” in a state of “half-sleep”. Similarities can be drawn to the process of the seemingly disparate AR images jarringly coming in and out of view (as seen in the final documented AR piece), layered atop one another. A passage from Andreas Mavromatis’s discussion on “dream scintillations”, in the text “Hypnogogia” (1987) also comes to mind while reading Ernst’s account. Quoting from psychiatrist M.J. Horowitz’s book “Image Formation and Cognition”, Mavromatis notes that “dream scintillations or flickering images” are a “rapid succession of images which intrude upon awareness and are difficult to remember” (225). In the case of Hallucinatory AR *I*, the images brought forth are “intrusions”, images that are not programmed to appear. These flickering AR images also “intrude upon awareness” in the sense that they interrupt and temporarily disassociate the awareness of the AR software to the appropriate marker. In the case of Ernst, and the Surrealists, these ‘scintillations’ are welcomed and embraced.

Mavromatis discusses how hypnogogia abounds in “strange combinations of images, words, or ideas, visual images viewed from unusual angles, fusions of images or ideas belonging to widely different matrices” (206). Mavromatis, familiar with Surrealism, comments upon how the “very peculiar marriages” in hypnogogia, which “convey a certain air of poetry”, has lead to “comparisons with Surrealist products” (206). He notes, “Indeed, the comparison with Surrealism is most fitting” (207). Mavromatis writes of Ernst and Breton’s work and automatist methods, commenting, “In surrealist artistic creations, as in hypnogogic imagery and mentation, well known objects are presented in a fantastic manner”, and continuing, quoting “Surrealism” (1960) author Arthur Schmeller, ““they are freely linked in a way unheard of in our conscious, wakeful, purposeful reality ... things penetrate each other and give birth to new beings no

longer after their kind' (207). Mavromatis, interestingly makes no mention of Lautreamont's often quoted allegory, famous for inspiring both Ernst and Breton, "As beautiful as the chance meeting on a dissecting-table of a sewing-machine and an umbrella", which became a definition of Surrealistic thought and is highly relevant to the ideas discussed (qtd. in Ernst, *Inspiration to Order* 66). In the AR hallucinations, too, these images become "freely linked" with new images in "chance" encounters, such as the fire in the window 'accident' I recounted. Mavromatis discusses "unpredictability as a regular feature of hypnogogia", referring to psychologist Peter McKellar's comparison of apparently disconnected sequences common to hypnogogia as "a mixed-up collection of lantern slides belonging to a number of different lectures" (206). This same analogy can also be used to describe AR hallucinations in that the slides or images programmed to different markers and contexts are jumbled in the software.

### **Theme: Transformation**

The AR image choices for *Hallucinatory AR I* attempted to work in tandem with the logic of dreams. In "The Secret Language of Dreams" (2004), David Fontana writes of how "clinical experience" revealed to Freud "that dream images interconnect by means of linking devices" (93). Fontana outlines these devices as "simultaneity", "contiguity" (in sequential occurrence), "transformation" (when one image dissolves into another), and lastly, "similarity", which according to Fontana, Freud considered to be "the most frequent and important linking device" (94). Fontana describes the device of similarity as operating "through association, as when one object resembles another in some way, or recalls or invokes feelings about that second object" (94). "Similarity" was a conscious influence and device applied in the process of selecting the AR images detailed.



“Transformation” was also demonstrated as a feature of the software during the AR hallucinations, flashing through multiple images which appeared to morph in and out of each other. Moskvitin too describes transformation, as well as similarity, which he refers to as “likeness”, in his discussion of dream logic. He writes:

The dreaming mind connects a whole series of events or objects by stressing a common denominator – an example would be the waves lazily rolling towards the slanting beach as sections of huge concentric circles, and this picture associating to the dancing telegraph wires seen from the windows of a train, before eventually transforming into the rings in the centre of a gramophone record when the switch does not function (112).

The likeness described above in dream logic echoes the intention of the images chosen to appear in *Hallucinatory AR I*, as described in the process section, of seemingly unrelated images melding into the forms of one another. The theme of association is further explored in *Hallucinatory AR II*.

## **Project 5: Hallucinatory AR II**

### **Process**

The process for creating the artwork *Hallucinatory AR II* evolved from the production of *Hallucinatory AR I* and the study of what types of non-marker imagery would evoke augmented imagery. The properties typical to non-marker imagery that generated AR images studied in *Hallucinatory AR I* were applied to the non-marker imagery in *Hallucinatory AR II* (See Figures 25-26, Appendix).<sup>10</sup> The projects differ in that the non-marker imagery itself became the content and focus in *Hallucinatory AR II*, not necessarily the augmented imagery which was conjured. *Hallucinatory AR II* explored the very act of the augmented imagery appearing, drawing a parallel with the act

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<sup>10</sup> The non-marker image in *Hallucinatory AR II* was converted from colour to black and white and the contrast was heightened to garner augmented imagery.

of reading and human memory with AR. The content of the non-marker image which caused these augmented images to appear was symbolic, consisting of a stained-glass window of an individual reading. This non-marker image served as a metaphor for the forms that emerged, mimicking the act of memory, imagination, and the perception of vision itself.

## **Project Themes and Theoretical Discussion**

### **Theme: The Act of Recollection**

Of particular interest to my work in AR is how emerging technologies have allowed us not only to see, but to see again that which is no longer, to recollect and to remember, and to recreate the past with verisimilitude. Darren Tofts and Murray McKeich refer to philosopher Henri Bergson's text "Matter and Memory" in their book "Memory Trade" (1998) in a discussion of memory and recollection in cyberculture. Tofts and Murray write, "The apparent problem of how the past remains with us and yet is in actuality no longer present, is resolved through the identification of recollection as being virtual" (66).

Whenever we are trying to recover a recollection, to call up some period of our history, we become conscious of an act sui generis by which we detach ourselves from the present in order to replace ourselves, first in the past in general, then in a certain region of the past – a work of adjustment, something like the focusing of a camera. But our recollection still remains virtual; we simply prepare ourselves to receive it by adopting the appropriate attitude. Little by little it comes into view like a condensing cloud; from the virtual state it passes into the actual; and as its outlines become more distinct and its surface takes on colour, it tends to imitate perception. (Bergson, 1988, 133-134 qtd. in Tofts and McKeich, 1998, 66)

My thoughts turn to the technology of AR, particularly the process in how the images and memories I have presented in my work come into view via the markers, and how this aligns with the action of recollection described above by Bergson as "virtual".

As the camera 'focuses' to view and read the patterns of the marker, "little by little" the image the marker is replaced with "comes into view like a condensing cloud", blurring, and shifting, becoming "more distinct" as the new "surface" image adjusts to the outlines of the marker's container. This technical process imitates the act of perception Bergson describes. At times in the practice of hallucinatory AR, the augmented image may 'break', or be temporarily interrupted, which may be thought of as a moment of distraction in recollection or the difficulty in attempting to place a memory or envision a particular image. These 'breaks' or fractures also serve as reminders of how fragile and fleeting these past moments were and are in their temporary instable state of (virtual) recollection. Hallucinatory AR II explores the technology of AR as parallel to the mental process of recollection.

### **Theme: Externalizing Mental Processes**

In 1916, Hugo Münsterberg, a Professor of Psychology at Harvard University, published, "The Photoplay: A Psychological Study", canonized today as one of the earliest theoretical texts on cinema. Münsterberg analyzed the form of film as mirroring mental activity. He discussed the essence of the new medium of film in regards to its ability to reproduce various mental functions on the screen stating, "The photoplay obeys the laws of the mind rather than those of the outer world" (92). Münsterberg provided an analysis in which he drew parallels between film techniques and mental functions such as memory and imagination. He described these correlations as the following:

Memory breaks into present events by bringing up pictures of the past: the photoplay is doing this by its frequent cutbacks, when pictures of events long past flit between those of the present. The imagination anticipates the future or overcomes reality by fancies and dreams; the photoplay is doing all this more richly than any chance imagination would succeed in doing. But chiefly, through our division of interest our mind is drawn hither and thither. We think of events

which run parallel in different places. The photoplay can show in intertwined scenes everything which our mind embraces. (170)

In the "Language of New Media" (2001), Lev Manovich discusses the introduction of novel media technologies as externalizing and objectifying the human mind. Manovich writes, "Interactive computer media perfectly fits this trend to externalize and objectify the mind's operations" (61). Manovich discusses the concept of hyperlinking, which he notes as forming the basis of interactive media, as objectifying the process of association that is central to human thinking. He discusses such mental processes as recollection, reflection, and problem solving as being externalized and aligned with the action of following a hyperlink, moving to a various page, and choosing a new scene or image. Manovich notes that before interactive computer media, one would look at an image or read a sentence of a story and "mentally follow" one's private associations to other images, and memories. Manovich is essentially arguing that with interactive computer media the viewer is being asked to follow pre-determined associations. He writes, "we are asked to mistake the structure of somebody's [sic] else mind for our own" (61).

I would here like to reflect on *Hallucinatory AR II* as embodying the notions of both Münsterberg and Manovich. My earlier discussion of *Hallucinatory AR II* in regards to Bergson's account of the act of perception and recollection can here be linked to Münsterberg's correlations between film and memory and the flickering of images and "cutbacks" presented in *Hallucinatory AR II* (See Figures 27-28, Appendix). This artwork is interesting to consider in respect to Manovich's claim of interactive computer media mimicking mental processes, which are, however, limited to pre-determined associations. In a sense, this can be said of the present structure of *Hallucinatory AR II*,

with the augmented images that are pre-programmed, or even 'hyperlinked', in the software's architecture. Initially, though, there is an element of chance, as described in *Hallucinatory I*, which comes into play, as unintended, or unplanned associations are drawn between the images which emerge from non-marker images. Manovich's claim of the individual being asked to mistake the structure of somebody else's mind for one's own is interesting to consider in regards to *Hallucinatory AR II* as the case of mistaken identity seems to occur not by the viewer, but in the mental (technical) processes of the software. The software here takes on the structure of 'someone else's mind', in a hallucinatory act of 'reading' non-marker images.

### **Theme: The Act of Reading as Hallucinatory**

I previously noted Manovich's statement that prior to interactive computer media, an individual would view an image or read and "mentally follow" one's personal associations to other images and memories. This is reflected in the first graphic that composes *Hallucinatory AR II*, a stained-glass image of a person opening a book and engaging in the act of reading. This image was inspired by German media theorist Friedrich Kittler's text, "Gramophone, Film, Typewriter" (1986). Kittler writes,

As long as the book was responsible for all serial data flows, words quivered with sensuality and memory. It was the passion of all reading to hallucinate meaning between the lines and letters: the visible and audible world of Romantic poetics. And the passion of all writing was (in the words of E.T.A. Hoffman) the poet's desire to "describe" the hallucinated "picture in one's mind with all its vivid colors, the light and the shade," in order to "strike [the] gentle reader like an electric shock. (10)

Kittler describes the very act of reading as hallucinatory, evoking memories and pictures in one's mind. Kittler claims, "Electricity itself put an end to this. Once memories and dreams, the dead and ghosts, become technically reproducible, readers and



writers no longer need the powers of hallucination” (10). I like to think of *Hallucinatory AR II* as providing an interesting take on this statement. In a way, *Hallucinatory AR II* is protesting the very medium of AR, by itself, stemming from a conflict occurring in the software, and culminating in hallucinations. I believe this is an important reminder that the human imagination, and the hallucinatory visions Kittler describes, need to continue to exist and be explored amidst new media and future technologies which emerge.

Introduced a new opportunity with which to explore the medium of AR from a creative approach and theoretical perspective. It was with a sense of awe of the flexibility and materiality of AR media, which was a new technology mimicking human perception and imagination.

In completing this research and creative work, my thoughts now turn to the future implications of AR, how the medium will emerge, and what effects it may come to have upon the production of culture and modes of communication. I speculate that AR will continue to be driven by commercial industry with an increase in applications in the entertainment sector, which I believe will be led by gaming, and with new opportunities arising in film production. Family and adventure theme parks are another form of recreation where we may see new types of AR experiences emerge, an instance where AR gaming and film can converge. I also foresee the technology of AR appealing to the world of advertising, as a means of communication to promote and solicit products and services, utilizing the “wow” factor of the medium to entice audiences.

I imagine the technology being used in ways across these various industries that will focus on the individual to create a personalized and customized experience. For instance in advertising, billboards and other new direct marketing devices may be

## **SECTION E: FUTURE IMPLICATIONS**

### **Implications for the Future of AR**

In exploring AR as a new creative medium, I did not know where this research or creative production would take me. I attempted to let the qualities of the technology direct and inspire me; the key factor to my work was the act of engaging with the medium directly through a process of trial and error. Each iteration of the work introduced a new opportunity with which to explore the medium of AR from a creative approach and theoretical perspective. I began with an investigation of the tactility and materiality of AR markers, and concluded with an inquiry into AR technology mimicking human perception and imagination.

In completing this research and creative work, my thoughts now turn to the future implications of AR, how the medium will emerge, and what effects it may come to have upon the production of culture and modes of communication. I speculate that AR will continue to be driven by commercial industry with an increase of applications in the entertainment sector, which I believe will be led by gaming, and with new opportunities arising in film production. Family and adventure theme parks are another form of recreation where we may see new types of AR experiences emerge, an instance where AR gaming and film can converge. I also foresee the technology of AR appealing to the world of advertising, as a means of communication to promote and solicit products and services, utilizing the “wow” factor of the medium to entice audiences.

I imagine the technology being used in ways across these various industries that will focus on the individual to create a personalized and customized experience. For instance in advertising, billboards and other new direct marketing devices may be

augmented to include images of individuals, or other customized AR elements, unique to each viewer amidst a large public. In gaming, as well, one can envision adding personalized augmented attributes, including featuring oneself as a lead character.

Perhaps in film, too, one will sit in a movie theatre and see themselves on the silver screen alongside famous actors simultaneously as other individuals also view themselves as that same augmented character. I make these speculations on the basis that, from my research and experiences, AR software is highly customizable; a single architecture may be used endlessly to insert various content to create a multitude of unique experiences.

These predictions are also based upon the premise that each individual may have their own unique set of software coding and database content, differing from others in a larger public. Hence, when one views an AR marker amid a crowd, each individual may be looking at an identical marker; however, the coding attributed to the individual's software may differ, thus garnering distinctive augmented content for each person. In the future, I envision AR software becoming nearly ubiquitous, perhaps a micro USB or Flash drive will be inserted into one's eyeglasses, which can be connected to one's personal computer to load and alter content, or distributed upon entry to an event to be 'plugged in' to one's eyeglasses.

I envision new spaces being created, new screens, and new arenas to view and participate in augmented experiences. Gaming and cultural tourism projects have already taken AR outdoors to city streets and historical sites. Film and other performative AR experiences too may come to occupy new outdoor territories and landscapes. In researching the types of applications AR has been utilized for thus far and extending these concepts into the future, my hypothesis is that spatially immersive experiences,

ones that fully encompass the individual's surroundings in large ways, will come to dominate the emergence of AR as a medium.

This forecast, however, is in opposition to the small-scale works I have created throughout this project. Nevertheless, I would still like to see such works emerge alongside larger scale projects for I believe that there is something wondrous and powerful about being able to hold and possess these AR experiences in one's hand. Such projects may come to exist with the development of prosumer AR software, which I predict will emerge. One factor for this will be partly due to the low-cost of equipment necessary (a web-cam and personal computer) for AR experiences. Artists may also come to collaborate with computer programmers and technologists to develop AR projects, through which new open source software may come to be available. It will be exciting to observe how other artists will embrace and even come to re-invent the medium alongside and/or in opposition to industry.

In addition to AR producers, it is interesting to contemplate how public audiences and consumers will come to receive AR. In "Virtual Art: Illusion to Immersion" (2004), new media art-historian Oliver Grau discusses how audiences are first overwhelmed by new and unaccustomed visual experiences, but later, once "habituation chips away at the illusion", the new medium no longer possesses "the power to captivate" (152)<sup>11</sup>. Grau writes that at this stage the medium becomes "stale and the audience is hardened to its attempts at illusion"; however, he notes, that it is at this stage that "the observers are

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<sup>11</sup> These ideas and concepts of habituation and wonder were previously discussed in regards to Tom Gunning and Viktor Shklovsky in Section B of this paper.

receptive to content and media competence” (152).<sup>12</sup> When the initial wonder and novelty of the technology wear off, will it be then that AR is explored as a possible media format for various content and receive a public reception? Or is there an element of wonder that need exist in the technology for it to be effective and flourish?

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<sup>12</sup> Grau furthers this statement by commenting that this reception occurs until finally a new medium with an even greater appeal to the senses emerges to “cast a spell of illusion over the audience again”, a process which has been “played out time and again in the history of European art since the end of the Middle Ages” (152).



## APPENDIX

## How Augmented Reality Works

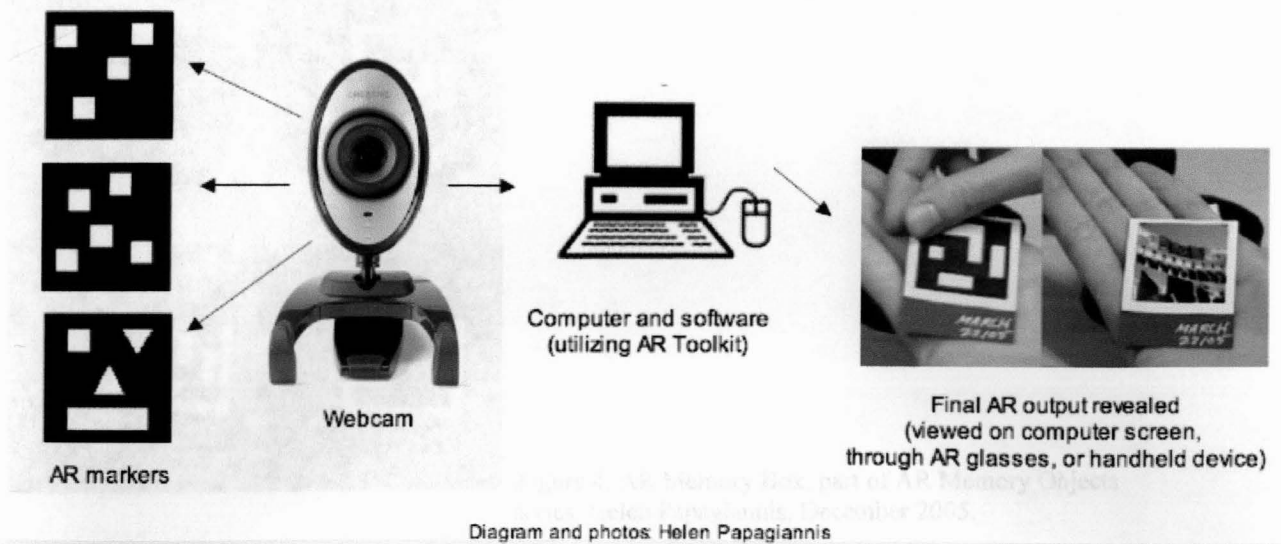


Figure 1. Diagram demonstrating how marker-based tracking works to create Augmented Reality experiences.

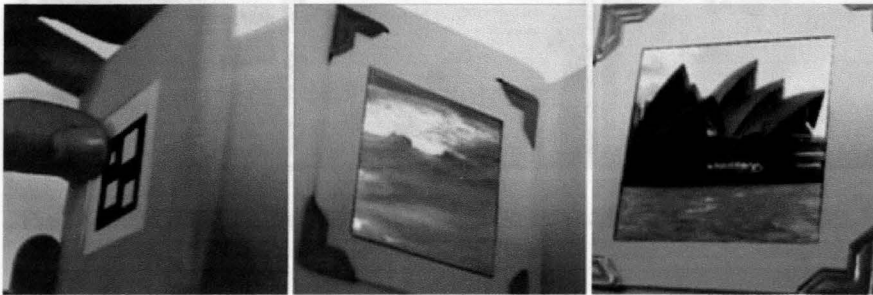


Figure 2. AR Memory Book, part of AR Memory Objects series, Helen Papagiannis, December 2005.

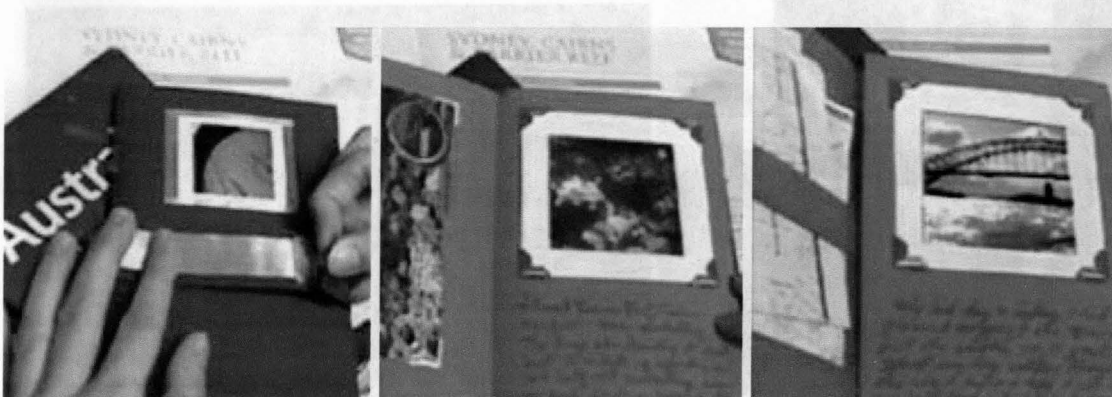


Figure 3. AR Travelogue, part of AR Memory Objects series, Helen Papagiannis, December 2005.

Figures 6-7. Images from the folding AR Pop-up paper Dollhouse Installation by Helen Papagiannis at the Film Studies Association of Canada (FSAAC) conference, York University, May 24-30, 2006.

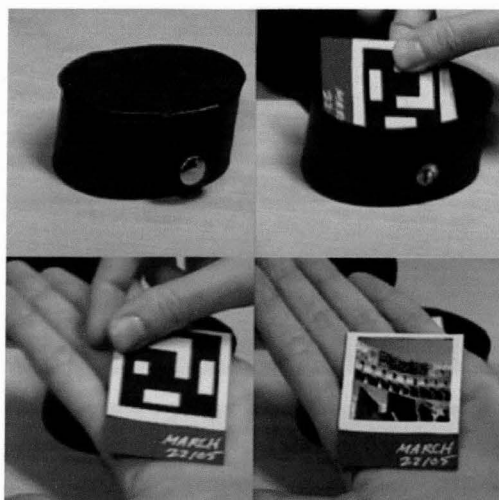


Figure 4. AR Memory Box, part of AR Memory Objects series, Helen Papagiannis, December 2005.

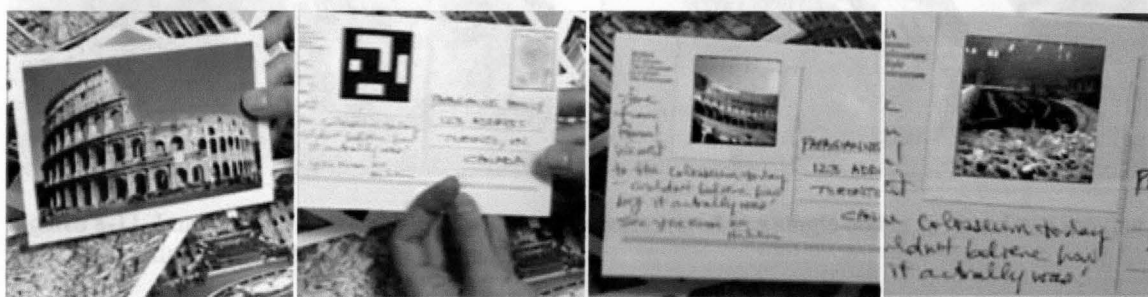
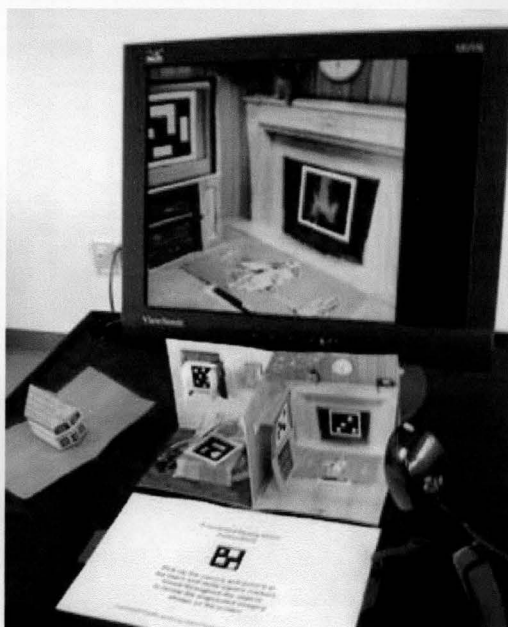
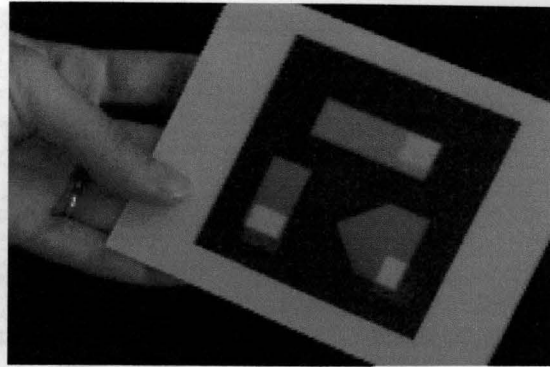
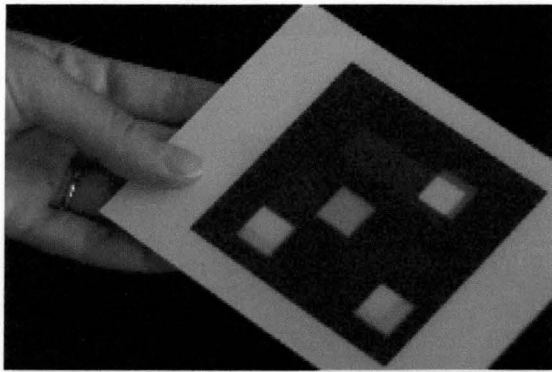


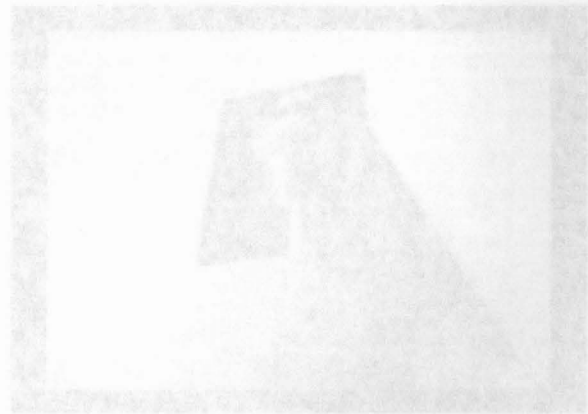
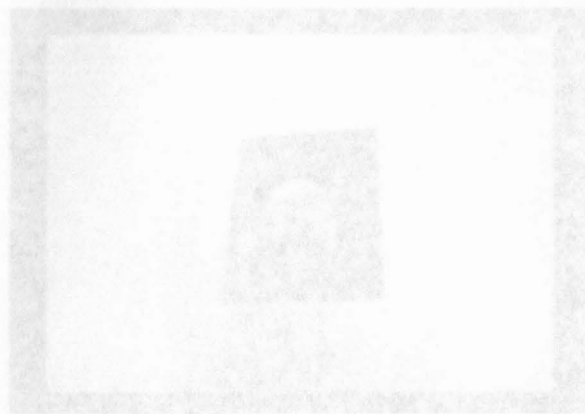
Figure 5. AR Postcard, part of AR Memory Objects series, Helen Papagiannis, December 2005.



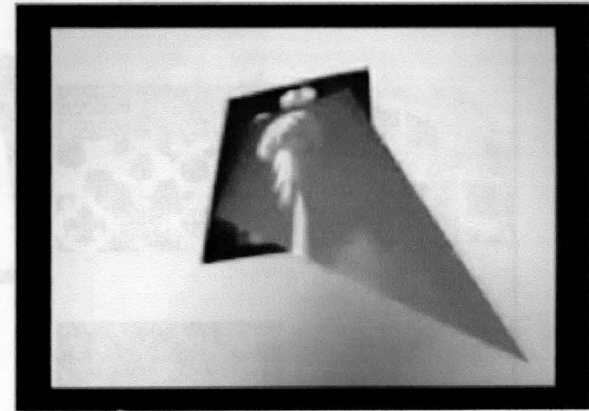
Figures 6-7. Images from the folding AR Pop-up paper Dollhouse installation by Helen Papagiannis at the Film Studies Association of Canada (FSAC) conference, York University, May 28-30, 2006.



Figures 8-11. Images from Lenticular AR, with two markers stored in a single object to reveal two moving pictures over time, Helen Papagiannis, August 2006.



Figures 9-14. Screen captures from Hallucinatory AR: Helen Papagiannis, August 2007.



Figures 9-14. Screen captures from *Hallucinatory AR I*, Helen Papagiannis, January 2007.

Figure 15. A sampling of images used in odd-marker testing in *Hallucinatory AR I*.





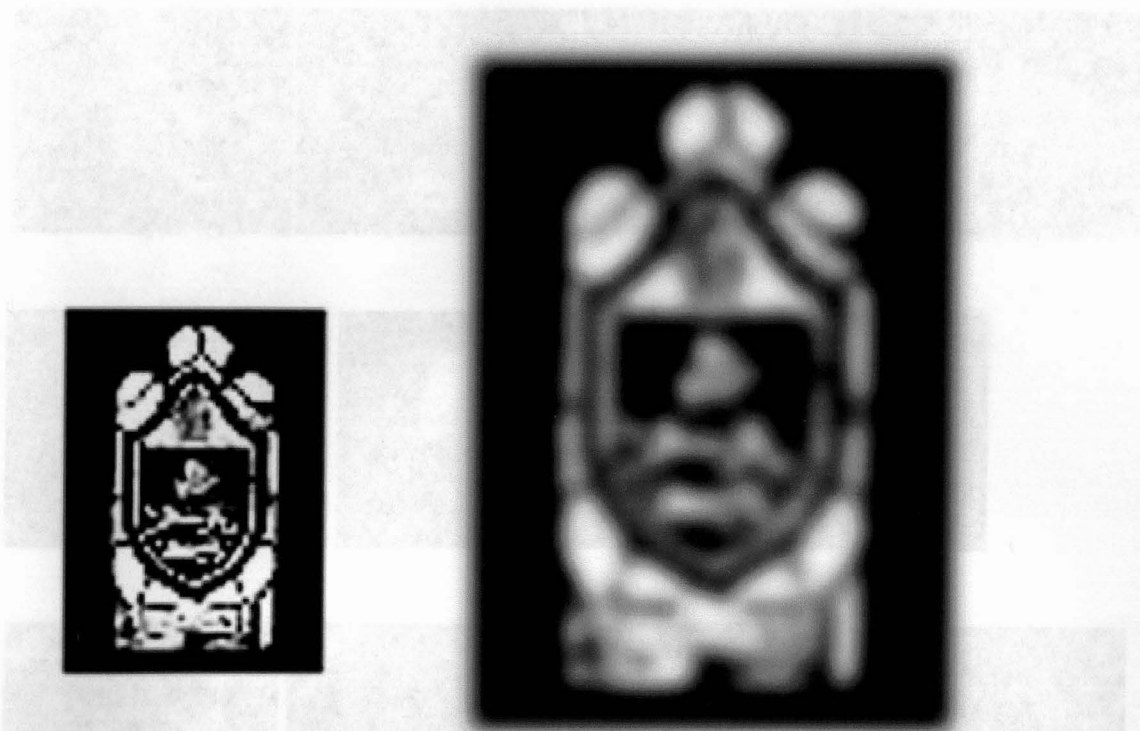


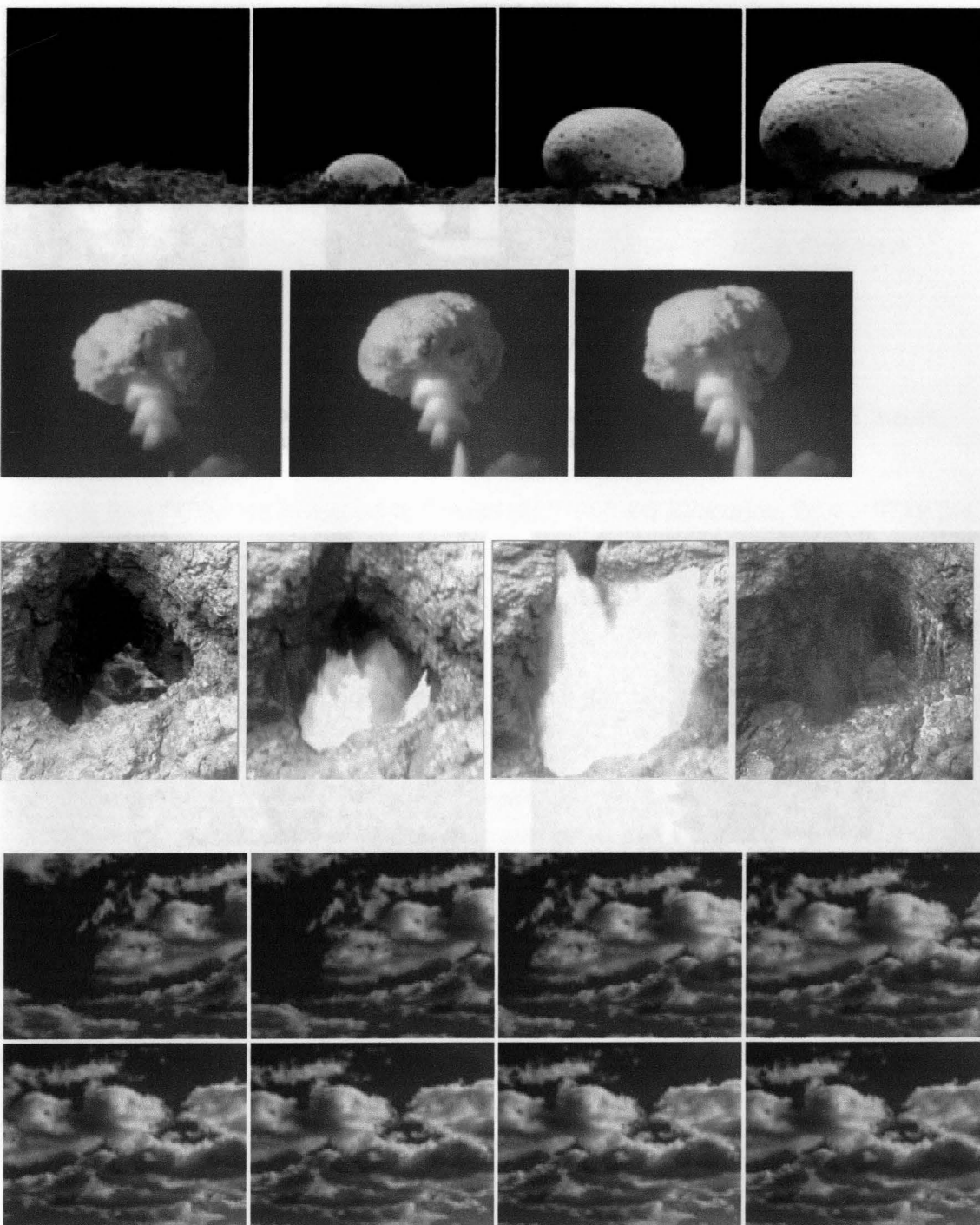
Figure 16. Left: original non-marker image used in Hallucinatory AR I.  
Figure 17. Right: original image blurred, revealing face.



Figure 18. The markers with which the AR images appearing from the non-marker image in Figures 16-17 are linked to. Utilized in Hallucinatory AR I.



Figure 19-20. Two additional images which were able to generate AR imagery in Hallucinatory AR I experiments.



Figures 21-24. Final selected AR video images (sequential storyboards for each clip) used in Hallucinatory AR *I*.

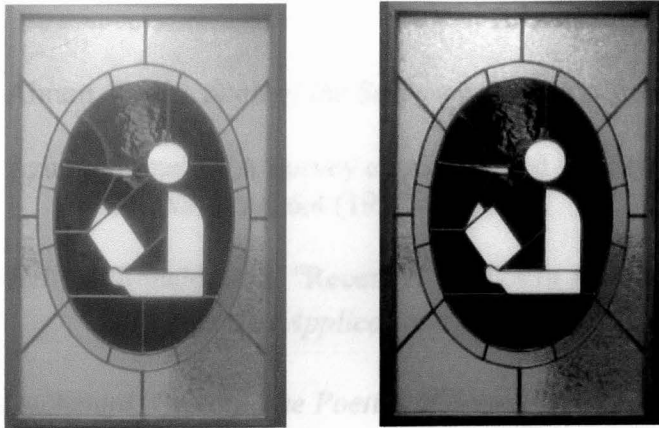


Figure 25. Left: original non-marker image used in Hallucinatory AR II

Figure 26. Right: final altered image used in Hallucinatory AR II

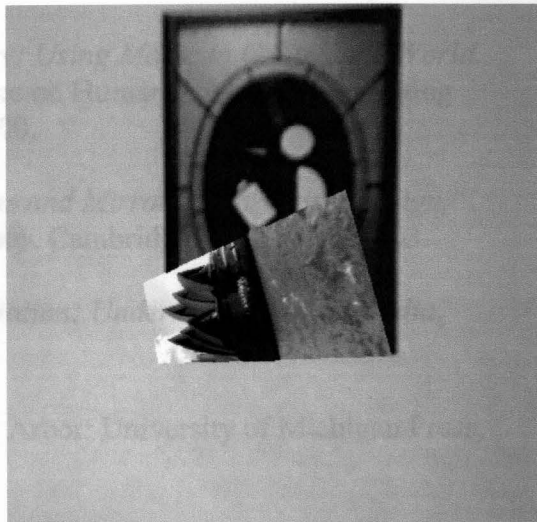
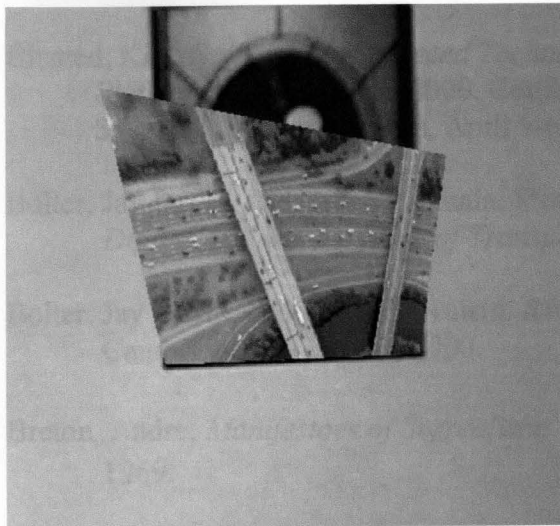


Figure 27-28. Screenshots from Hallucinatory AR II showing two different augmented images appear from a non-marker image, Helen Papagiannis, July 2007.

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