skin

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THESIS COMMITTEE

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Abstract

Skin, the biggest organ of the human body and the medium of physical contact that surrounds each and every one of us, has been a recurring subject in the research and artwork of this artist. Virtual Reality, because of its uniqueness as an experiential medium for the rendition of hybrid realities and dialogical situations between physical and digital existence, manifested as the experimental platform for the articulation and visualization of "senses of touch".

This work describes *skin, 2006*, a hyperstereoscopic high-definition interactive audiovisual installation that explores the intersection of the body as a landscape/mindscape and the body's own traces of touch.

Keywords: Hyperstereoscopic video, Virtual reality art, Interactive installation, Electro, CWall, skin

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Hyperstereoscopic Video Research & Editing

Helen-Nicole Kostis

Application Development

Robert Kooima

Helen-Nicole Kostis

Sound Composition & Design

John Kannenberg

Lighting tips

Stephen Cady

Color correction

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Installation

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To creative adventures
To endless playgrounds
And to stereo lovers

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Table of Contents

List of Figures

Preface

The uniqueness of Virtual Reality (VR) as a medium and its specificities as a topic of research occupied most of my Master of Fine Arts (MFA) years. Being a student and researcher in the Electronic Visualization Laboratory (EVL) provided me with the opportunity to actively and practically explore and experiment with virtuality concepts and aesthetics and tele-immersive[I] environments.

Entering virtual realities, experiencing immersive and interactive environments, and the magical illusion of depth with stereoscopic systems seem to create a sense of "a new world". As Oliver Wendell Holmes remarked in 1861 in one of several Atlantic Monthly articles on stereoscopes: "The shutting out of surrounding objects, and the concentration of whole attention…produces a dream-like exaltation…in which we seem to leave the body behind us and sail into one strange scene after another, like disembodied spirits"[1].

VR and its relationship with physical reality became a recurring subject of my research, as well as the positioning of VR as a different, non-alien type of our physical reality. "Virtual and physical interact in such a way that the one enhances, extends, or functions as an aiding prosthesis to the other, culminating in a "go together" world"[2], as the space is now both of real and virtual nature.

[I] Tele-immersion connects remote places, via networking through a shared virtual environment.

Intrigued by Alan Lightman's novel "Einstein's Dreams"[3] and his take on Einstein's relativity concepts such as questioning and contradicting the nature of time, place, and space, my thoughts regarding linearity and non-linearity of space and time started to evolve. At the same time, the everyday experience of cyber-life as a parallel life through electronic mail and tele-conferencing usage, as well as the potentiality of alternative identity formation in online conversations contributed to a stronger identification of digital realities with "parallel universes" in my everyday life. Presence, whether physical or virtual, is already intermixed and thoroughly convoluted. For example, being in a CAVE®[II]-like system and experiencing a virtual environment automatically duplicates both realities and identities. The body is in two spaces at the same time, one being the physical CAVE-like installation room and the other the virtual environment. Realities and identities grow by adding tele-immersive capabilities, a case that also applies to tele-conferencing.

The first exploratory environment/installation questioning the above concepts was *Dinner at the Fairy Castle: A Virtual Set, 2004*: this experimental collaborative project was displayed in an installation room that included an ImmersaDesk®[III] system and aimed at producing low cost alternatives of Special Effects and movie-making. Together with James Lee and Tina Shah, we recreated virtually the dining room of the popular Fairy Castle exhibit at the Museum of Science and Industry at Chicago, IL, USA. We "keyed" audience participants in the miniature room in real-

[II] CAVE® is a multi-person, room-sized, high-resolution 3D video and audio environment invented at EVL in 1991. Graphics are projected in stereo onto three walls and the floor, and viewed with active stereo glasses equipped with a location sensor. As the use moves within the display boundaries, the correct perspective is displayed in real-time to achieve a fully immersive experience. For more information, please visit: http://www.evl.uic.edu

[III] ImmersaDesk® is a stereoscopic display system. It was developed in 1994 at EVL. It is a drafting table VR display and it is portable and self-contained CAVE-like system. For more information, please visit: http://www.evl.uic.edu time by utilizing a retro-reflective screen, an LED ring, physical studio props, and a virtual world that could be explored and navigated, inverting concepts of real and virtual, small and large.

In *Interplay: Loose Minds in a Box, 2005*, an Access Grid®[IV] art performance, in collaboration with Another Language Performing Arts Company[V] and six universities and research laboratories across North America[VI], we produced a multi-faceted telematic event that consisted of six simultaneous performances which explored the basic characteristics of the "box". The box served as a metaphor for the physical, social, political or psychological constraints that we and/or others project upon us. The box represented a sense of place in the realm of the virtual as well as in our sub-conscience. With a team of over 26 artists/technologists, the distributed performances incorporated text, theater, music, performance art, virtual reality, and motion capture, and were concurrently mixed, encoded, and streamed onto Internet2. In the EVL site, together with Tina Shah we explored the concept of isolated confinement in a physical performance with audience participation, while exposing the metamorphosis of the performer's psyche "keyed" in a VR world.

[IV] The Access Grid® is an ensemble of resources including multimedia large-format displays, presentation and interactive environments, and interfaces to Grid middleware and to visualization environments. These resources are used to support group-to-group interactions across the Grid. For more information, please visit: http://www.accessgrid.org

[V] Another Language is an interdisciplinary dance company, founded in 1985 by Beth and Jimmy Miklavcic. The mission of Another Language is to combine different art forms in innovative ways, and to broaden access to community arts education with the aid of today's communications technology. For more information, please visit: http://www.anotherlanguage.org

[VI] The sites included the University of Utah Center for High Performance Computing, the University of Alaska, Fairbanks and the Arctic Region Supercomputing Center, the University of Montana, Missoula, Envision Center for Data Perceptualization at Purdue University, the Electronic Visualization Laboratory at University of Illinois, Chicago and the University of Maryland, College Park.

In *Virtual Unism, 2005*, a tele-immersive artwork in collaboration with Gosia Koscielak and Daria Tsoupikova, we explored how Unistic[VII] theories can be translated, interpreted, and extended to Virtual Reality in order to create harmonic experiences addressing the human senses, such as sight with visuals, hearing with sound, and balance with motion. For this experimental artwork we recreated digitally most of the physical sculptures that were created and later destroyed by Katarzyna Kobro, an early 20th century art pioneer, and "according to popular opinion, Kobro's works were supposedly a sculptural version of Unism"[4]. In *Virtual Unism, 2005* these virtual sculptural objects were studied and then extended and transformed into a compositional, architectural, interactive Unistic universe.

Finally, the project *skin*, was conceived, and the description of its implementation is the subject of the present paper.

[VII] Unism was a movement of several Polish artists in the mid-1920s who were seeking to go beyond Kasimir Malevich's prinicples to an art of all-over composition in which oppositions were minimal. Katarzyna Kobro and Wladyslaw Strzeminski in their book Space Compositions: Space-Time Rhythm and Its Calculations from 1931, described the mathematics of the open spatial compositions in terms of an 8:5 ratio. They developed a theory of the organic character of sculpture, a fusion of Strzeminski's Unistic theory of painting and Kobro's ideas about sculpture's basis in human rhythms of movement, time-space rhythm, and mathematical symbolism. For more information, please visit: http://www.evl.uic.edu/virtualunism/

1 Introduction

FIGURE 1.1: *real-time interaction with skin, 2006*

1.1 *skin*: Synopsis

skin is a real-time interactive installation that visualizes a dialogue between physical and digital senses of "touch". The installation consists of a screen representing artificial skin, onto which hyper-stereo skin-related video imagery is projected. The imagery is accompanied by a generative composition of digitally manipulated and synthesized skin sounds: porous breathing, the friction of skin on various surfaces, and synthesized representations of the electrical pulses inherent in skin at the molecular level. These skin-derived media serve as an exploration of a new territory: the intersection of the human body as a landscape/mindscape and the body's own traces of touch.

By reacting to the imagery, the participating audience deforms virtually the skin-derived media. Physical gestures are translated into accentuated and non-literal digital deformations of the projected imagery while new sounds, both organic and synthetic, are added to the mix to accompany these deformations.

1.2 Statement

...i imagine a world of skin

"... I see our bodies as huge landscapes covered with skin and then these skin landscapes grow bigger than us, they penetrate our Cartesian world and suddenly start creating extensions of our bodies and different forms of landscapes and then I get immersed in these landscapes and they become more than just literal landscapes of skin – they become innerscapes or mindscapes -landscapes of the mind."

helen-nicole kostis, 2005

Skin is the largest organ in the human body. It is the medium that surrounds each and every one of us. The body is "[...], nothing but strata of skin in which interiority and exteriority are thoroughly convoluted"[5]. Skin is an anatomical barrier; it is the boundary that separates the internal from the external self and world. It is a prophylactic membrane. Acting on that membrane, what we call skin, amplifies the fragility of that boundary and blurs the borders between self and other. Skin is a container of a biochemical manufactory and a fragile complex organic structure. It is the medium of physical contact among living creatures since natural skin carries a variety of nerve endings, providing our somatic sense of touch. “Skin is connected to our bodies yet also alien, marking the exterior – the end of our selves. It is a screen on which we can watch the body's amazing ability to heal itself while also witnessing its inevitable collapse”[6]. Skin possesses a unique beauty and a unique ability to objectify our vulnerability.

1.3 Revisiting the Subject

In 2003, I unwittingly engaged in sculpting a gigantic surface that resembled skin as if viewed under a microscope: it was an ill-surfaced skin with indentations and scarifications, as shown in Figure 1.2. At the same period, I was making renditions of confused environments: I created a physical sculpture and then worked on recreating it; rendering it digitally and having it float in a skin-surfaced 3D environment. It was the time that I started experimenting with dialogical situations of physical and digital realities invading each other, making it unclear where each part came from. I felt that they created unique instances of existence. I continued experimenting with these situations and, later on, I started taking pictures and video of this scarred skin to create

3D renderings, where vulnerability – "soft pain"[VIII] – is portrayed on landscapes of boiling territories and skin-duned mountains. The work is called "natural phenomena" Figure 1.3. It is a diptych of two renders: the left one portrays the outside of a slow-breathing belly-skin surface. The right one shows the inside world of that body surface, a growing territory of mountains covered with the sculptural skin surface I had created in 2003.

I have scars in my body that are associated with physical pain and each one of them has a dyadic story – a sweet one, which cherishes events prior to the event of the scar/wound, and a sad one, which reflects the mournful event of scarring and its long painful healing process.

[VIII] soft pain is a term the artist uses to describe human vulnerability.

FIGURE 1.2: *Photographic images of skin, 2003 [20ft x 8ft latex, saw dust, shoe thread, vaseline]*

FIGURE 1.3: *natural phenomena, 2004*

These scars, the renovated skin, have become part of my identity by forming new skin and then becoming all one. The way they have transformed and healed resembles our transformation as human beings with the passage of time, our vulnerability, and our temporal existence, since “death, like life is not a momentary event but is an ongoing process whose traces line the body. At the point where I make contact with the world, I am always already dead”[5].

1.4 The Herzogian Landscape

Transforming skin visuals from a derma-type of imagery to a *skin landscape* experience is one subject of this artist's skin-related body of work. *skin, 2003* was intended as an architectural installation – where a wall would attain human texture, keeping up with the concept of *humans leaking everywhere.*

Slowly-moving images of formations in *natural phenomena (video), 2004,* and in *skin, 2006,* simulate the organic behavior of human breathing, having a rhythm of an almost hypnotic behavior. This motion provides the time to delve in and become part of them. The slow-motion technique along with the landscape treatment is mastered in Werner Herzog's films.

The filmmaker, Werner Herzog has a unique way of treating landscapes. He transforms them to something bigger than their image by holding a single shot of a landscape for an unusually long time. These long shots are apparent in most of his films, for example *Fata Morgana* (1971), *Fitzcarraldo* (1982), *Where the Green Ants Dream* (1984), *Cobra Verde* (1987), *Aguirre: The Wrath of God* (1972), *The White Diamond* (2004) and *The Wild Blue Yonder* (2005). Werner Herzog does not shoot landscapes; he directs them. "It gives you time to really climb inside the landscapes, and them to climb deep inside you"[7]. These landscapes become states of mind, where our deepest fears and emotions arise; they become dreamlike visions.

1.5 Description

The installation consists of a dark room and a floor-to-ceiling projection of a hyper-stereoscopic high-definition video piece. The looped video is of non-narrative form. It consists of five scenes of stillies – moving images of slow motion of formed body shapes, as shown in Figure 1.4. The skin-derived background sound composition is constantly being re-generated.

Visitors may walk close to the screen and put on the polarized glasses. The polarized glasses allow the audience to experience stereoscopic vision. The piece is also interactive. Participants can hold the Wanda™ [IX], which is suspended from the ceiling. By means of a tracking antenna that is is located on top of the screen and connected to a computer , and a tracking sensor that is embedded in the Wanda, physical motions and forward or backward gestures from the wand deform the skin imagery respectively inwards or outwards. The gestures are accompanied by deformation sounds.

The user interacts with the stereoscopic video imagery by performing touch-like motions. The magnitude of the deformation that is "sculpted" on the moving image grows larger as the participant moves the Wanda closer to or further away from the screen.

[IX] The Wanda is the major input device used to interact with and control a virtual reality experience in the CAVE, ImmersaDesk and other VR systems. It is essentially a 3D mouse, with a receiving antenna attached which provides the computer with information about the Wanda's position and orientation. Wanda is commercially available from Ascension Technology Corporation. For more information please visit the following sites: http://www.evl.uic.edu, http://www.wandavr.com

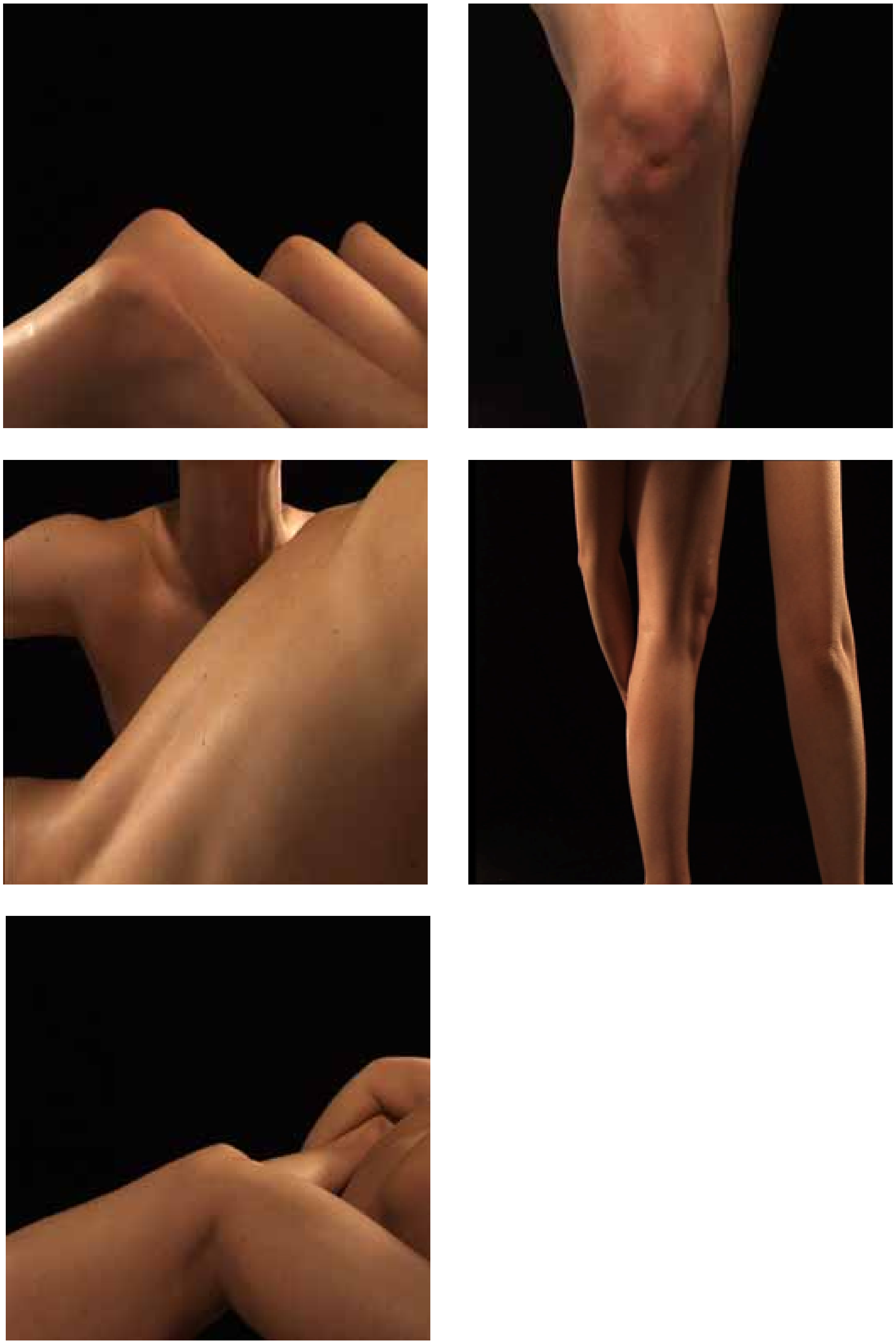

FIGURE 1.4: *Screenshots of the five scenes of skin, 2006*

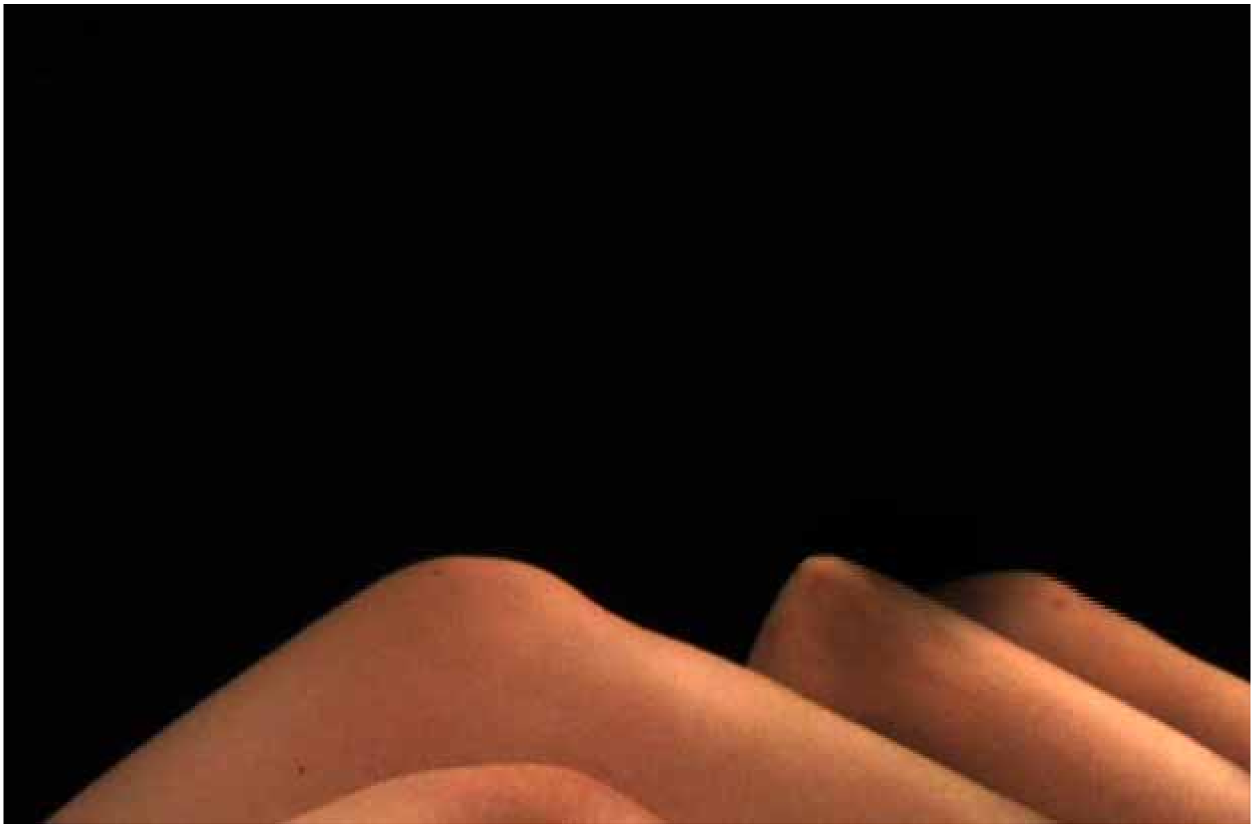

FIGURE 1.5: *Real-time screenshots of interaction of the five scenes of skin, 2006*

2 Skin Culture & Perspectives

Skin, the biggest organ of the human body with a complex structure, has been a research theme in different areas ranging from bioengineering, to visual arts and films. In addition, skin surfaces are also becoming increasingly apparent in architecture and design as prophylactic structures and containers mimicking the look, feel and behavior of living organisms. In the following paragraphs works and research from these areas are described. Appendix B contains a detailed list of skin culture & perspectives.

2.1 Skin & bioengineering research

Artificial skin is mainly developed on a bio-chemical basis and applicable in burn wounds, leg ulcers, diabetic foot ulcers, and damaged skin. The first artificial skin was created by Professor Ioannis V. Yannas, a chemist and biomedical engineer at MIT, and his collaborator Dr. John F. Burke, Professor emeritus at Harvard Medical School and Massachusetts General Hospital. In 1991 it was approved for use in plastic surgery and after fifteen years of clinical testing, in March 1996, the FDA approved the use of artificial skin for the treatment of burns. It is a "revolutionary product in that it allows for the actual regeneration of skin badly damaged by burns or other trauma, rather than the formation of scar tissue"[8]. Professor Yannas solved with his discovery "the short-term problem of survival and the long-term problem of quality of life"[9]. The artificial skin is being implanted on burn patients and other damaged body parts. One of the advances in his discovery is the fact that "the new skin also grows as the patients do, an important consideration for burned children"[9].

Another revolutionary research is also under way: manufacturing human skin cells using a printer similar to an inkjet. The Ink-Jet Printing of Human Cells Project is led by Dr. Brian Derby at the University of Manchester, UK. This promising project may be ready for clinical trials within five years, allowing "scientists to eventually build commercial skin printers for hospital use"[10]. In the mean time, temporary skin substitutes can be prescribed by physicians, such as Apligraf®[X] and TrasCyte™ [XI].

"The vision of real artificial skin, that can substitute all skin functions, is still question of future,[…] and the journey to the possibility of 'wearing' artificial skin is long"[11]. This is especially so because "the sense of touch has proved particularly difficult to duplicate through artificial sensors due to the harsh environments such as artificial 'skins'"[11].

[X] Appligraf is supplied aa s living, bi-layered skin substitute. Apligraf consists of living cells and structural proteins. For more information please visit: http://www.apligraf.com

[XI] TransCyte Human Fibroblast Derived Temporary Skin Substitute – Temporary wound covering for surgically excised full-thickness and partial-thickness burns. For more information, please visit: http://www.smith-nephew.com/

2.2 Skin art

Historically the representation of the human form and body has been presented to be one of the oldest forms of art. In addition, modifications, incisions, and decorations of the body and skin are thoroughly interconnected between art, society, religion and spirituality. Examining all these aspects in a historical context, even though it is interesting topic, it is not a subject of this paper. In this section this artist will briefly describe influential artists and some of their artwork.

Marina Abramovich is a performance artist who has experimented with body art performances throughout her 30-year career, such as *Thomas Lips, 1975*, and *Cleaning the House, 1995*. Abramovich uses her body as her primary material, pushing it to the limits and exploring the physical and mental limits of her being. She has endured pain, exhaustion, and danger in the quest for emotional and spiritual transformation.

Stelarc's prosthetic assisted performances, *Stomach sculpture* and a current project *The Extra Ear (or an ear on an arm)* revolve around his concept that the *human body is obsolete* and his works involve robotics that extend the capabilities of the human body.

Jill Scott's *Taped, 1975,* performance, consisted of a "figure that stood on the tops of two twenty-foot ladders, one foot on each ladder and leaned against the outside wall of a warehouse. Two assistants took ten rolls of two inch-making tape and stuck the figure to the wall, defying gravity, until sundown"[12].

John Coplans "photographs his own naked body inch by square inch up close, twisting it to abstraction while also documenting the sadness of aging"[13].His photographs are not self-portraits, since he is always excluding the head. He refuses to flatter his own naked body. Instead he highlights every wrinkle, discoloration, fold of fat, hair and he performs/creates shapes more reminiscent of animals or a landscape than of a human body.

Tattooed Skin, 1972 4x5 inch, by Ulay, was a 4x5 inch portion of the skin of the artist Ulay with the tattooed question: “How deep does it go?”. The skin was removed and presented as a work, literally separated from the author. It was presented like a sculpture or a photographic image. In a poetic way, the answer to the question suddenly seems clear: skin-deep.

2.3 Skin surfaces, design & architecture

Skin surfaces are becoming increasingly apparent in fashion, design, and architecture as prophylactic surfaces and containers mimicking the behavior, look and feel of living organisms. Some exemplary works are described briefly in the paragraphs below.

Stahl Stenslie and Kirk Woolford in 1994 created the *inter_skin* project. “In the *inter_skin* suit the body becomes the interface for communication between the participants. It becomes an “interskin” to convey exchange and receive information. Both participants wear a sensoric outfit that is capable of both transmitting and receiving different multi sensoric stimuli. The main emphasis of the communication is in the transmission and receiving of touch. By touching my own body I transmit the same touch to my recipient. The strength of the touch is determined by the duration of the touch. The longer I touch myself, the stronger stimuli you will feel."[14]

Matthieu Manche has created and designed *Fresh* (1998-2000): a series of latex garments that propose connections between various body parts and among multiple wearers, and suggest new possible body formations. Carla Murray and Peter Allen designed *TechnoLust* (2000): "a garment that incorporates the use of soft technology™"[6] and "seeks to merge the softness of skin with the hard lines of consumer electronics"[6]. It is a wearable gaming device, worn as an undergarment taking advantage of wireless internet technology. Tonita Abeyta's Sensate (2000-2001) propose the design of an undergarment with male or female latex condoms built-in a cotton panty, with the help of the California Medical Innovations Company.

Wearable computing and design is already mainstream and in commercial production, so there is a big community of designers, artists, and engineers trying to alter the way that a computer should be used and to transform the myth of the computer into a wearable experience. In 1995, Nicholas Negroponte in his *Being Digital* bestseller, predicted about wearable media: "Computing corduroy, memory muslin, and solar silk might be the literal fabric of tomorrow's digital dress. Instead of carrying your laptop, wear it. While this may sound outrageous, we are already starting to carry more and more computing and communications equipment on our body" [15]. And he continues "With a little digital help, people's ears could work as well as "rabbit ears"" [15]. Following the archetype of wearable media, clothing and accessories have transformed from ordinary garments to intelligent surfaces. Smooth curves, smart fabrics and organic design have embedded machines into clothing transcending them into intelligent fashion and suggesting new skins for these devices, as well as for ourselves.

Protective covers – “skins” – have become a new type of culture in our everyday life. The cult of the iPod, the stylish portable player from Apple, has introduced several new cultural phenomena and a whole new virtual subculture. One of them is the emergence of a market for designing customized shielding facades for iPods, as consumers often describe that the iPod has become part of themselves – a body extension. These “skins” not only do they serve as protective garments, but they can also offer a new customized look and feel for the hottest gadget for the moment.

In the digital realm, virtual skins have developed into a trend in they daily computing way of life. Downloadable “skins” from the Web and the custom design of application interfaces, such as operating systems, tools, software, and development environments, is a field by itself. These skins/interfaces personalize the appearance of “skinnable“ software, providing the user with the opportunity to choose color, appearance, style and size.

Organic appearance and the creation of architectural skins is one of the most interesting fields in architecture today. An instance of a building borrowing from the organic appearance of bubbles and sustainable architecture is the upcoming “Water Cube”, the National Swimming Centre in Beijing, China for the Olympics of 2008. The façade of the building will consist of an infinite array of soap-like bubbles, offering water conservation services and the usage of solar energy for the heating of the pools and the buildings interior area. Architectural skins are also responsible for conserving a building’s energy. Double-façade buildings, the usage of photovoltaic systems and sustainable design, improve the building’s interior environment (better indoor air quality, access to daylight) and energy efficiency (energy saving in the cold season, protection from external noise and wind) and advance its high-tech image.

2.4 Skin-like materials

Since ancient times alabaster was used in small sculptural perfume bottles, for sacred objects to figure sculptures. “Alabaster skin” is often used as a term to describe white, pale skin. Alabaster as a material has the characteristics of a creamy white color, with a translucency resembling human white skin.

Materials like latex, rubber and silicone which have a controllable viscosity and translucency are often used in sculpture to represent skin-like surfaces as well as for the development of robotic skins.

Elastane fabrics, spandex and Lycra® are used in a wide variety of product manufacturing ranging from undergarments and clothing to soft shells for various products and devices. Costumes, stretched ceiling systems and tension fabric architectural structures made of Barrisol® fabric and by Pink INC. are another example of organically shaped wall surfaces.

“Smart materials” respond to environmental stimuli and their properties can be altered in a controlled fashion from external parameters, such as stress, temperature, moisture, pH, electric or magnetic fields. These “smart materials” are utilized in the field of “e-textile” (Electronic textile) for the fabrication of multifunctional interactive fabrics, which are flexible and comfortable to the human body and provide fabrics where sensor function, electronics and interconnections are woven into them. These electronic textiles provide the possibility of making the everyday life healthier, safe, and easier, through the realization of easy-to-use interfaces between humans and devices. ElekTex™ “smart fabric” technology is currently being used to integrate portable entertainment and mobile computing into garments, accessories and new products with particularly increased tactile feedback and durability.

2.5 Skin in films

Depictions of skin are apparent in diverse genres of films, interpreting a different language for the revelation of skin. Sexual or erotic scenes/films which focus on nudity, with their emphasis on inferring skin as flesh and physical desire often appeal to the emotions of the viewer. Along with the genre of romantic films, a whole new genre of film industry started to evolve, immediately after the screenings of the very first film in the late 1800's – the genre of pornographic films.

Sci-fi movies usually portray extra-terrestrial life forms, alien creatures of anthropomorphic nature and intelligent behavior. Skin-like creatures that breed on humans are frequently represented as hostile and as a threat to the human race, as in the *Alien* film series. Commonly, powerful and intelligent robots with physical appearance indistinguishable from that of humans are apparent in science fiction films, such as *Blade Runner*, as well as skin-like devices and forms as portals in other dimensions of realities as in Cronenberg's *existenZ* and *Videodrome.* It is not common for those aliens to be embodied as benevolent and in peaceful contact with humans, as in the film of Steven Spielberg, *ET: the Extra –Terrestrial,* with the famous scene of human to alien-ET contact.

2.6 Skin & society

Human skin tone can range from almost black to nearly colorless in different people. The color of skin is determined by the amount of the pigment called “melanin” in the skin. The color of skin during human civilization has created controversy, racial issues, and has led to wars, segregation, and slavery. Human skin color has been a metaphor for racial classifications, which sometimes have been regarded also as purely social constructs. The concept of categorizing people in races according to their color of skin, whether it is “white”, “black”, “yellow” or “red” and intermediate color variations, is a historical phenomenon and has been used in order to denote the geographic origin of a population.

The human skin is probably the most commonly altered part of the human body. Tattoos, body piercing, scarification and body markings are very old forms of body art and they date from 5,000 years ago. Different civilizations have been practicing body modifications for different reasons. In few groups tattoos are an integral part of their religion, community, or tribe and each person is required to have a mark on their body symbolizing the person’s authority as a group member. In some other groups body modifications are part of spiritual practices and even cathartic experiences. As civilizations developed and progressed body art took on additional meanings and today they can signify membership in a particular group or even gang, a “special or memorable moment in one’s life” or just a fashionable intrusion to the body.

In popular fashion and men’s magazines skin is usually portrayed young, shiny, smooth, and ageless and, depending on fashion trends, sometimes tanned. It is the “glamorously flawless” skin, in most cases digitally manipulated and corrected, that usually gains a primary position in a tabloid, an advertisement, a poster, in TV and magazines. Revolutionary skin-care products promise wrinkle-free looking skin, whereas cosmetic surgery, implants, and skin rejuvenation treatments comprise a whole new industry targeting among other goals “the extension of life”.

3 Research, Development & Production

As the concept of the piece began to take form, it became clear that the piece itself should be a stereoscopic, high-definition, interactive video installation. In order to meet all these requirements, the following structural elements had to be researched:

- Open-source software supporting real-time interaction, sound and, most importantly, stereoscopic high-definition video playback.
- The process of shooting and producing stereoscopic video.
- Interaction design.
- Sound design and composition.

3.1 Software: Electro

After careful consideration and research of available software solutions, the artist decided that the piece would be developed on the recently released application development environment called Electro. The selection criteria were the following:

- Open-source license.
- Cross-platform implementation.

- Independence from commercially-licensed software.
- Support for input handling both from external devices and via network.

"Electro is an open-source application development environment, developed by Robert Kooima, PhD candidate in the Electronic Visualization Laboratory. It is designed for use on both cluster-driver tiled displays and desktop systems, which provides support for 3D graphics, 2D graphics, audio, and input handling. Following the paradigm of an easy-to-use-scripting system, Electro is based on the MPI process model and is bound to the Lua programming language for the development of interactive applications spanning multiple processors and displays."[16] Therefore, Electro applications can be configured for stereoscopic display systems, such as the C-Wall (Configurable Wall)[XII], and can accept tracking data from external devices.

During the development of the artwork, the artist worked closely with Robert Kooima[17] following his technical advice. At the same time, Robert was generously adding new features to the core Electro development, in order to facilitate the technical needs for the production of the piece.

[XII] C-Wall functions as a one-wall, low-cost CAVE in terms of performance and compatibility with CAVElib software. For more information, please visit: http://www.evl.uic.edu

3.2 Hyperstereo Video

Stereoscopic video for the piece was shot using two Sony HD camcorders: models HDR-FX1 and HVR-ZIU. This artist experimented using empirical methods and mathematical concepts of stereoscopy in order to understand, learn, and accomplish stereoscopic video production. During this stage it was very important to have the guidance and advice of her research advisor and mentor, Daniel J. Sandin [18].

The stereoscopic video for the piece is overlaid on two digital meshes of n-number of vertices (where n is a variable), where each video sequence is attached and mapped, frame-by-frame, as an image. Electro keeps the playback of the two streams in-sync. The video sequences on the meshes are hard-coded[XIII] for alignment in order to achieve better fusion of the stereo.

The finalized stereoscopic video technique, along with tips, technical limitations and solutions, is documented in detail in Appendix A: Hyper-stereo video.

[XIII] Each sequence of the video is aligned specially, in order to have better stereo. Different scenes were shot in different days or instances. That might have resulted in small separation of both cameras. For more information, please visit Appendix A, in this paper.

3.3 Interaction Design

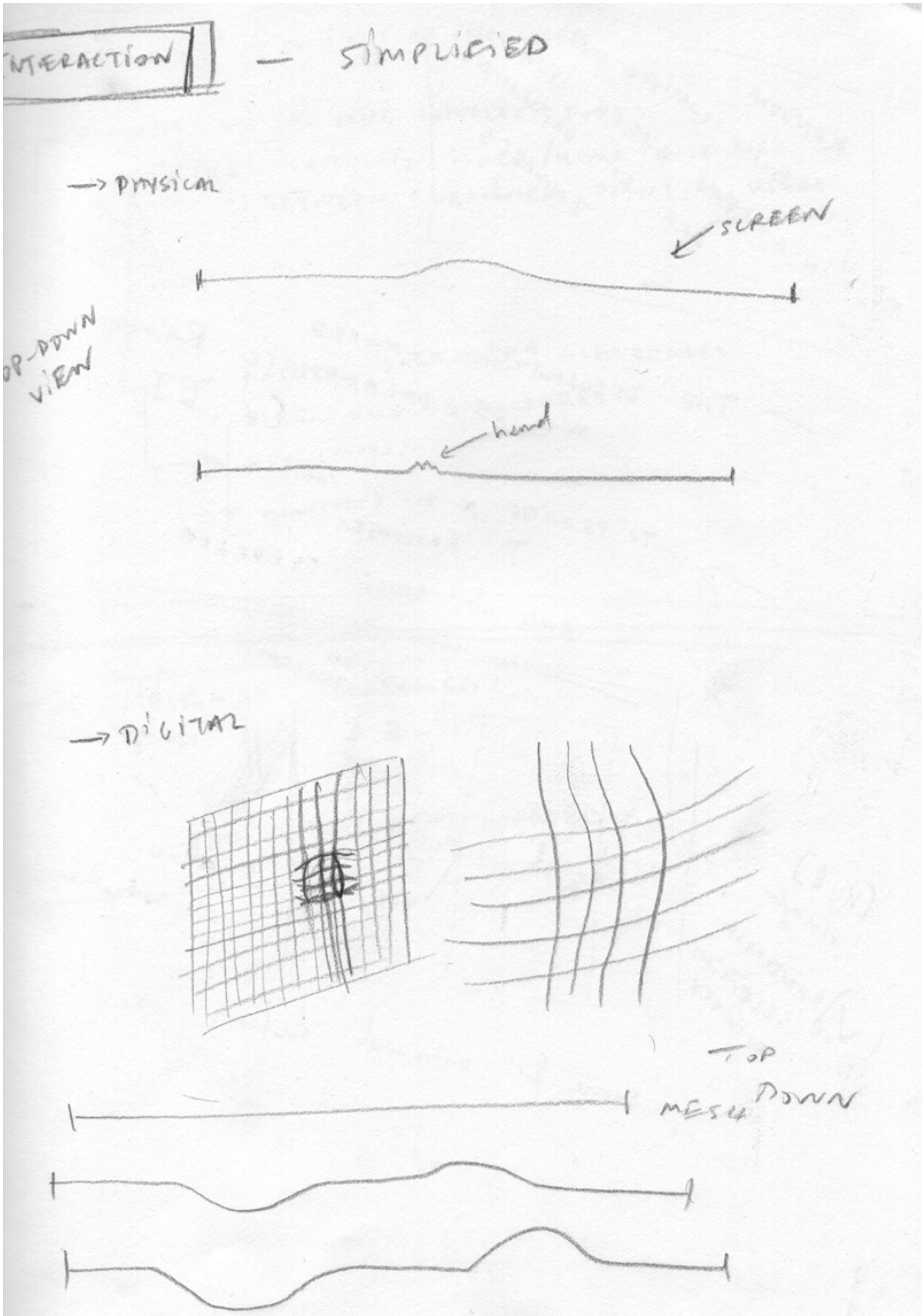

FIGURE 3.1: *Interaction design sketches, 2005*

A critical aspect for the interactivity was the translation of the physical motion to the digital deformation of the image, as it is sketched in Figure 3.1. As the hyperstereo video imagery is played back on two digital meshes (one for the left and one for the right eye), the position of the Wanda, which was used as a handheld tracking device, was mapped by Electro to the appropriate X and Y coordinates of each mesh. A smooth Gaussian deformation was developed by Robert Kooima in order to resolve performance issues and create smoother deformations.

3.4 Sound Design & Composition

For the sound design and composition the artist collaborated with John Kannenberg[19], independent artist and curator of the digital art space Stasisfield.com.

The audio track for the piece comprises multiple instances of recorded skin/organic sounds, like porous breathing, the friction of the skin on various surfaces, and swallowing, which are then electronically manipulated and abstracted. Once an interaction event occurs these multiple sounds are entered into a generative process along with deformation sounds and the background composition is rendered.

John Kannenberg describes his sound design and composition, in the following paragraphs:

“In keeping with the installation’s macro-view of oversized skin imagery, the sound accompanying the visuals also exaggerates scale, amplifying small sounds to create a large sonic space. A background bed of sound is created using simple generative techniques, with four sounds of differing lengths creating a subtle, malleable sense of closeness to skin. The porous nature of skin is represented by the repetition of breath-derived sounds, while the constant friction of skin against skin, hair and clothing is represented by time-stretched sounds of skin rubbing against various surfaces, as well as recordings of the composer's throat while eating and drinking. At the same time, purely synthesized tones serve as a reminder of the electric impulses that inhabit skin at the molecular level. The contrast between organic and synthesized sounds echoes the digital manipulation of raw skin imagery in the installation's video.

As the audience's physical interactions with the screen manipulate the video, a similar interaction occurs sonically. Both organic and synthesized sounds accompany these visual deformations, some of which are sonically related to the background sounds while others are strikingly different.

Sounds for the project were derived from recordings of the composer's skin as well as purely synthesized sounds created using modified synthesizers in Propellorhead's Reason software. The sounds were edited using Bias' Peak editor as well as Apple's Soundtrack."

4 Exhibition

skin premiered on May 12th, 2006 during the opening of the *Drawing Current: Electronic Visualization MFA Thesis Exhibition* and was continually shown in its entirety for the duration of the exhibition until May 15th, 2006. The exhibition took place in the Great Space Gallery located on the Fifth Floor of the CUPPA Hall building, University of Illinois at Chicago, at 400 S. Peoria Street in Chicago.

4.1 Installation

The Great Space Gallery has a main loft space and two smaller gallery spaces. *skin* was installed in the southeast room of the Great Space Gallery on a C-Wall system that was configured and constructed on location [Figure 4.1 & 4.2]. The C-Wall system is a site-specific, high-quality, circularly polarized passive stereo wall with tracking. It functions as a one-wall CAVE room. The C-Wall employed for the exhibition of *skin* utilized two high definition JVC projectors with circularly polarized filters mounted on the front of the projector lenses [Figure 4.3]. The projectors were set

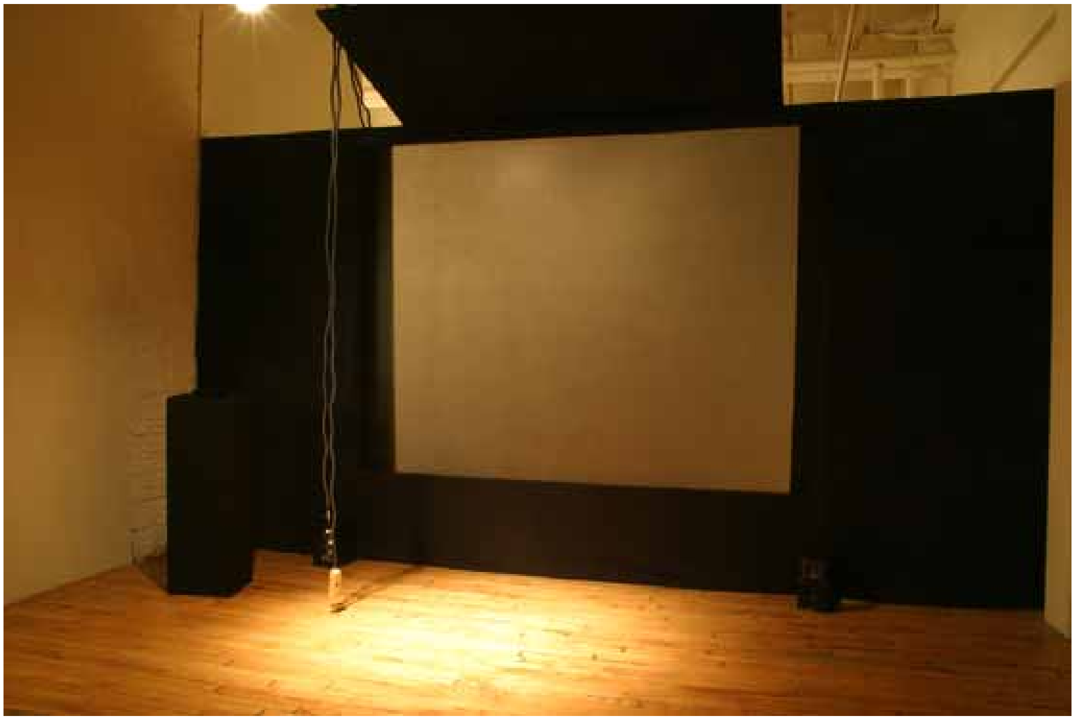

FIGURE 4.1: *C-Wall setup, Great Space Gallery, 2006*

up for rear projection [Figure 4.4]. An 8 x 6 ft polarization-preserving *Black Screen* [Figure 4.5] from Stewart Filmscreen Corporation was frame-mounted and embedded on a wooden scaffold. The scaffold was built on-site and functioned as a wall standing approximately one foot from the floor at a 10-feet distance from the projectors. The scaffold was covered with black flame-retardant commando cloth for two reasons: to create the illusion of a black wall and also to avoid any disturbance of the projections by any possible light-spillage from the covered windows behind the screen. On the one side of the setup, the commando cloth was attached to the scaffold with Velcro material, in order to provide an easy access/entrance to the rear side of the setup [Figure 4.6].

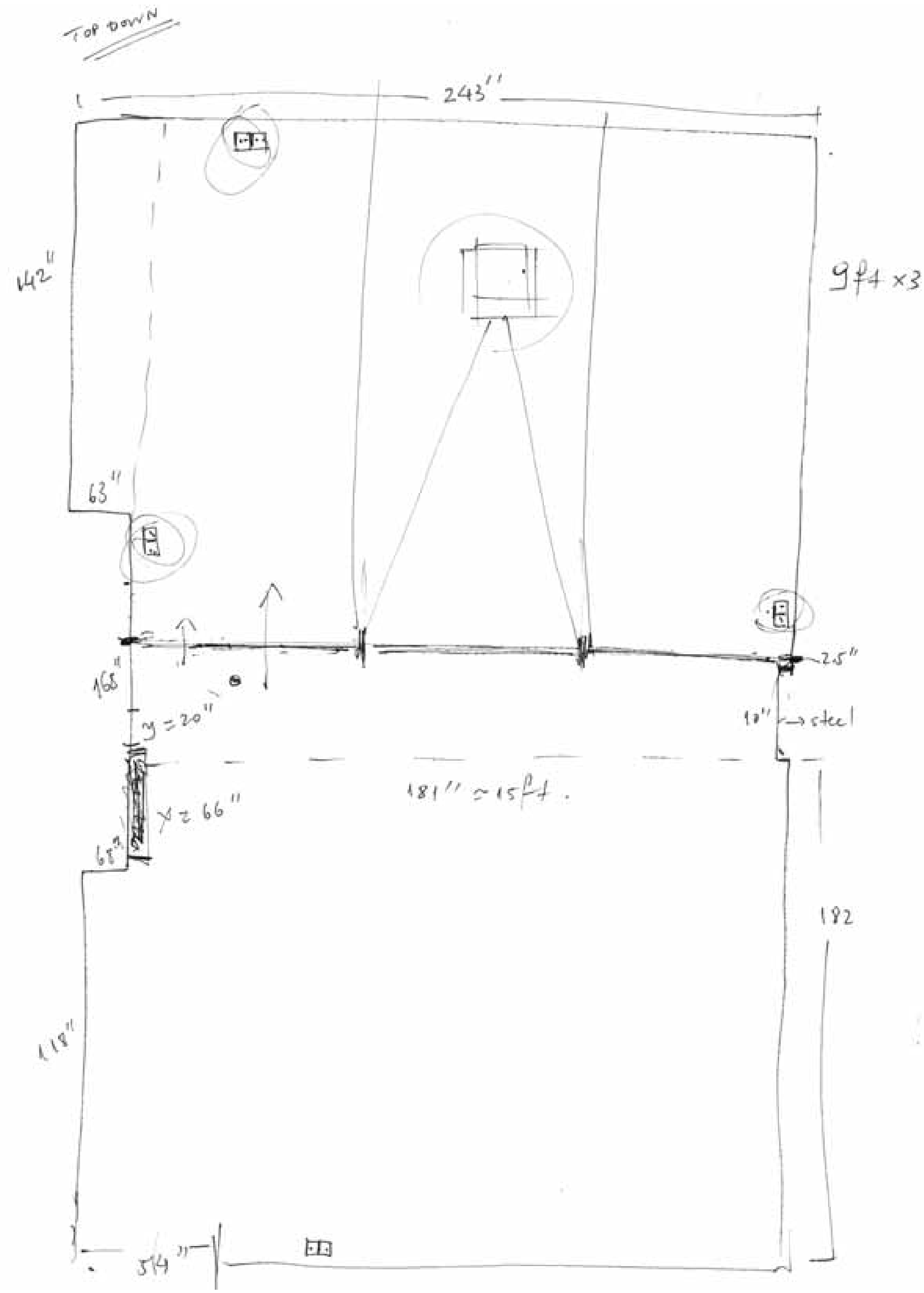

FIGURE 4.2: *Top-down sketch of southeast room, Great Space Gallery, 2006*

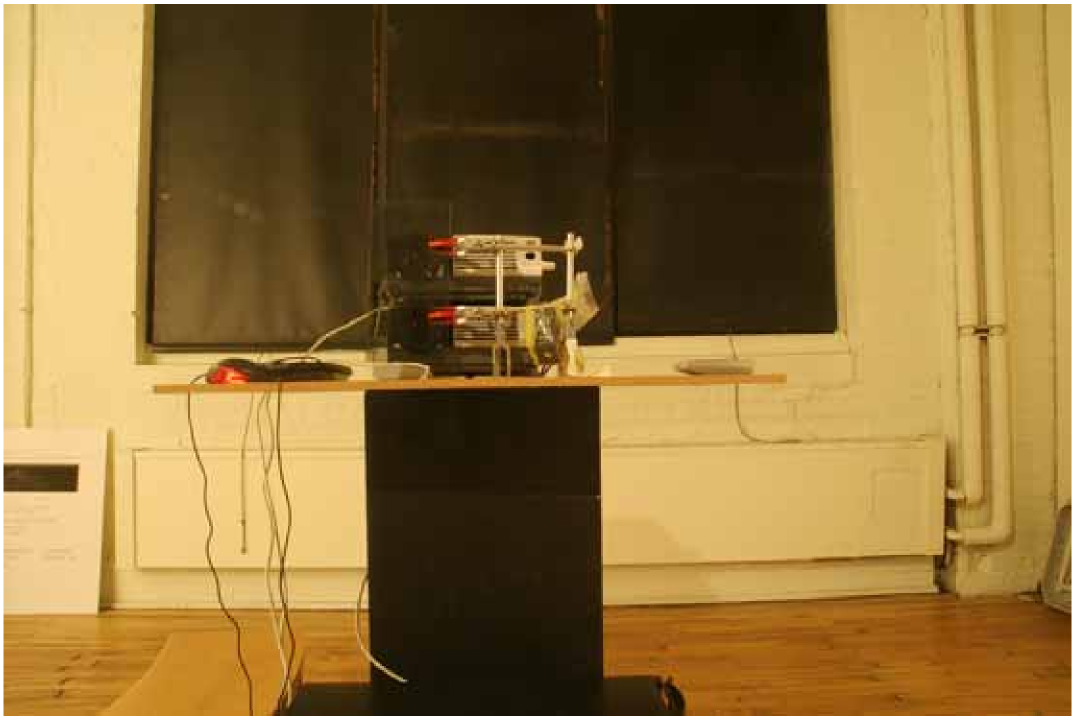

FIGURE 4.3: *projectors with circularly polarized filters, 2006*

FIGURE 4.4: *Rear view of setup, 2006*

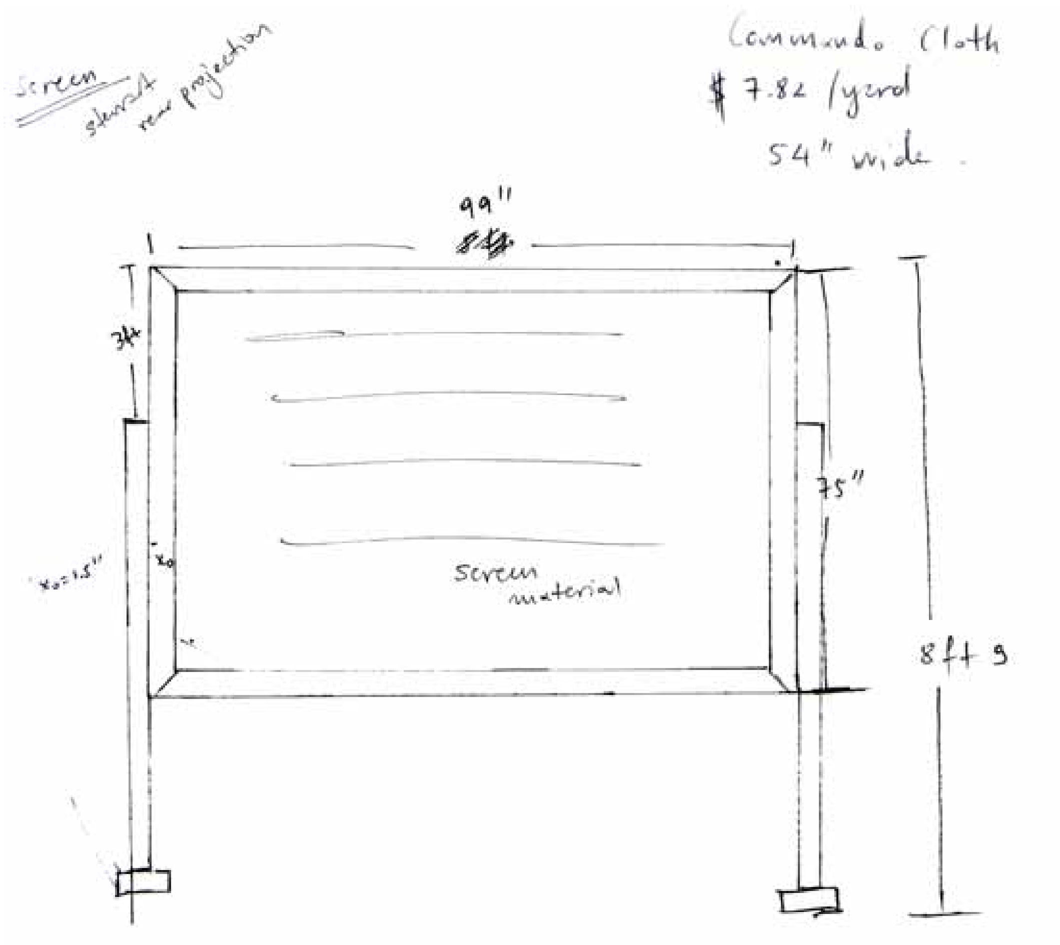

FIGURE 4.5: *Sketch of polarization preserving projection screen, 2006*

A hand-constructed SpacePad[XIV] antenna, mounted on a cardboard panel and covered with commando cloth, was hung at a 60 degree angle from the top of wooden frame towards the ceiling and facing the front side of the projection screen [Figure 4.1 & 4.6]. The 2 receiving anntennae provided tracking for the head sensor and the Wanda controller [Figure 4.7]. All tracking-device cables were inserted in black spiral tubes [Figure 4.7 & 4.8] for aesthetic purposes. The stereoscopic imagery, sound, and interactivity is driven by two machines: a tracking PC with an installed SpacePad and a

XIV The SpacePad anntena, consists of three wire loops mounted on cardboard panel and configured on a flat plane that is inclined, and held in place above the C-Wall. For more information, please visit: http://www.evl.uic.edu

Trackd® [XV] server (*machine 1*) and a linux desktop computer (*machine 2*) which runs Electro and a Trackd client in order to accept the tracking data from the Trackd server [Figure 4.9].

Two black GENELEC® [XVI] speakers were connected to a mixer and the mixer itself to *machine 2*, provided the generative audio for the piece. The speakers were placed on the front side of the screen on the floor, being almost invisible by the audience. Finally, a pedestal, covered also in black commando cloth, was used for the placement of the non-tracked polarized glasses that were provided to the audience [Figure 4.8]

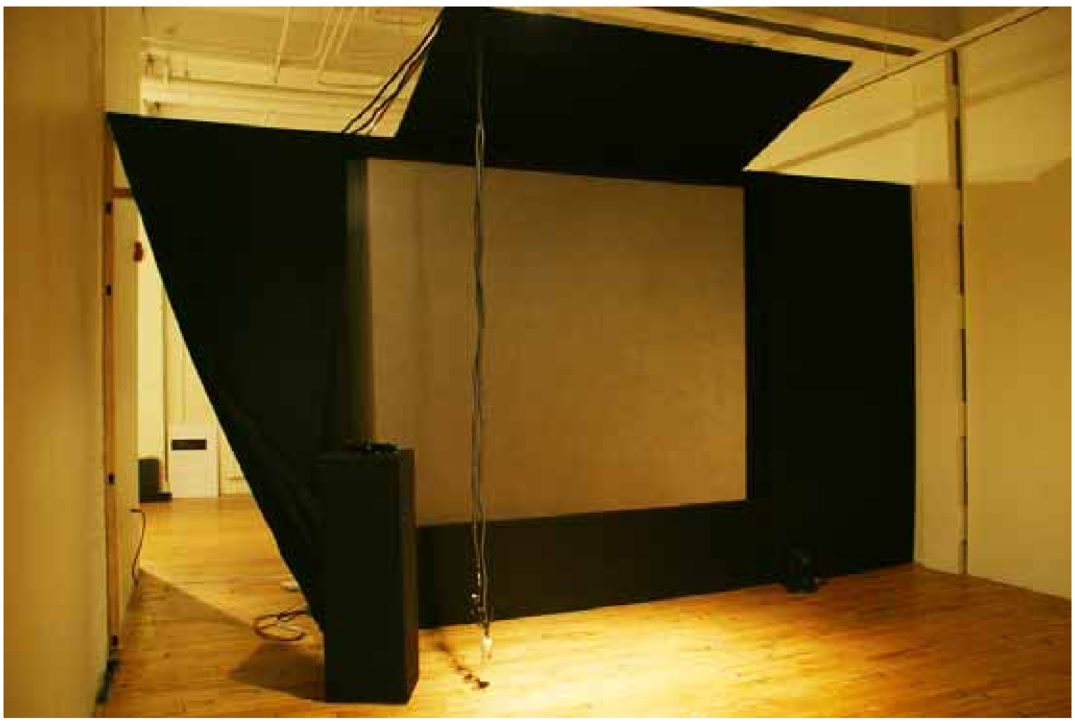

FIGURE 4.6: *Entrance to the rear side of the setup, 2006*

[XV] The Trackd is the standard device software for VR environments and input device manufacturers in the immersive display industry. The Trackd is a small "daemon" application that takes information from a variety of tracking and input devices and makes that information available for other applications to use. For more information, please visit:
http://www.vrco.com

[XVI] GENELEC is a Finiish company that develops audio products. For more information, please visit:
http://www.genelec.com

FIGURE 4.7: *Head sensor and the Wanda, 2006*

FIGURE 4.8: *Pedestal with audience glasses and black spiral tubes for the cables, 2006*

FIGURE 4.9: *Setup of machines & equipment, 2006*

FIGURE 4.10: *Setup of machines & equipment, 2006*

5 Conclusion

The purpose of this paper is to demonstrate the creative process from conception to production to realization: it discusses and makes apparent the creative, experimental, and analytical processes of transforming and articulating visions to realities. Furthermore, it reveals processes of self-exploration for meaning and delineates the associated concepts of outcome and destination.

Future work may incorporate the addition of different forms and types of interactivity, as alternatives to the Wanda, using either a haptic/tactile interface or tracking via pattern recognition. Other directions may include the creation of installations using touch screens as a proxy of skin-to-skin contact or even the human skin/body as an interface.

skin, 2006 will continue to be shown in conferences, festivals and digital media venues and its progress can be tracked at: http://www.evl.uic.edu/eleni/thesis

A Hyperstereoscopic Video

The purpose of this Appendix is to provide some background history to stereo, introduce hyperstereo as a term and present information of the Hyperstereoscopic Video process that was employed for the production of *skin,* step by step. This Appendix can function as a tutorial on Stereoscopic/Hyperstereoscopic Video Production, as well.

A.1 An Introduction to Stereo Vision

Euclid in 300BC and Claudius Gallen in 175AD observed that each eye sees objects differently. Later Leonardo da Vinci in 1519 noticed that binocular vision adds a relief to the perception of objects. It was, however, 1833 when Charles Wheatstone, physicist, first realized the significance of binocular vision. Wheatstone observed that the image disparities as the result of parallax [XVII] are the source of relief perception. He named this perception "stereopsis" [XVIII] from the Greek word for "solid view".

[XVII] Parallax or motion parallax is derived from the Greek word (παραλλαγή - parallagé) for alteration. Parallax is the change of angular position of two stationary points relative to each other as seen by an observer, due to the motion of an observer. It is the apparent shift of an object against a background due to a change in observer position.

[XVIII] Stereopsis comes from two Greek roots: stereo (στέρεο) meaning solidity and opsis (όψη) meaning vision or sight.

He invented the "stereoscope", a device to observe pictures in three dimensions, and from that time on the applications of binocular vision progressed. By the 1850's stereopornography had been well established and the Holmes Stereo Viewer was invented in 1861. After the Second World War, the View-Master[XIX], a little plastic stereoscope became popular with consumers. Holography[XX] was invented by 1947, while Polaroid invented Vectorgraphs[XXI] and lenticular stereograms[XXII]. Later came the production of 3D films that could be viewed through red-and-green or Polaroid glasses. Finally, research led to the invention of Virtual Reality, animated 3D movies and Autostereoscopic systems [XXIII] were introduced. Today, the field of stereoscopic vision applications and systems is still evolving.

[XIX] View-Master was first introduced at the New York World's Fair in 1939 and it was invented by William Gruber. Intended as an alternative to the postcard with 7 3D Kodachrome images on a paper disk, it was originally marketed through photo shops, stationary stores and scenic attraction gift shops.

[XX] Holography comes from two Greek roots: ὁλος-holos meaning whole and γραφή-graphe meaning writing. It was invented by Dr. Dennis Gabor at the Imperial College of London. It is the science of producing holograms. It is a technique which allows the recording and playback of true, three-dimensional images. In 1971 , Dr. Gabor received the Nobel Prize in physics for holography.

[XXI] A Polaroid Vectograph print is a graphic medium based on the polarization of light. The Vectorgraph print is a three dimensional image that can be experienced with properly polarized 3D glasses.

[XXII] Lenticular stereograms have been used for many years to display a true three-dimensional stereoscopic image without the need for the observer to wear special selection devices (eyeglasses) that selectively permit the left eye and right eye to see different images. The lenticular stereogram is made by photomechanical reproduction and most commonly used for trading cards, picture postcards, product displays, and the like. By incorporating a cylindrical lenticular screen that has a corduroy-like surface over a properly encoded image print, a stereoscopic three-dimensional depth effect may be achieved.

[XXIII] Autostereoscopic systems display three-dimensional images that can be viewed without the need to wear special glasses on the part of the user and afford an effective sense of immersion.

A.2 Hyperstereo

Hyperstereo a term introduced by Charles Wheatstone in 1857, refers to a stereo image which uses a larger than normal stereo base (or separation). A “normal” stereo image separation is about 65 mm (2.5 inches), which is the average distance between the two human eyes; anything further apart than this distance is called *hyperstereo*.

Hyperstereo, as well as “normal” stereo, is obtained with one or two cameras for the production of still photographs or moving images. Depending on the subject, the distance between the lenses of the cameras recording the right and left images can vary from anything greater than 2.5 inches to tens and hundreds feet apart. Hyperstereo photography is usually employed for landscape stereo photography, like mountainous areas, city skylines, clouds, and in general very distant objects; it gives a stereoscopic depth effect to very distant objects that normally appear flat.

A.3 Goals, technical limitations and resolutions

The artist experimented with the following key elements for the development of the piece as a visual experience:

1. Stereoscopic video.

   Some basic requirements for a stereoscopic image are:

   - The whole image has to be in focus.
   - There must be no vertical parallax in the picture.

- The photographic base has to be 1/30th of the distance between the subject and the camera lens.
- The content is with good depth of field.
- The camera is mounted horizontally.

2. High Definition imagery.

   The choice of High Definition versus Standard Definition imagery was mostly based on two reasons:

   - It allowed for high-detail quality images, especially desired for the specific content of the piece.
   - It provided a unique opportunity for a learning experience with two recently purchased Sony HD cameras, which were the best available cameras in the lab at the time.

3. Skin content for the video imagery in landscape/mindscape formations.

   The artist chose to work with a skin color closest to her own (white Caucasian). The coloration of skin (white Caucasian) is very subtle and it is difficult to capture it in video. It was important to the artist to be able to participate in the video as a subject and to provide her skin as the content of the piece and herself as the subject of deformations. The video imagery included a performative aspect that allowed the artist to play a dual role: director and performer. From this dual perspective this artist attempted to form imagery that worked well as stereoscopic video.

4. Close-up of skin.

   The search for the optimum proximity of the "close-up" required the careful consideration of a number of parameters, such as the need to retain stereoscopic views and achieve good depth of field, the specific cameras and lenses, and the size of the studio space that the shooting/production of the video took place.

The lab equipment used that imposed technical limitations that should be considered for the video shooting process were the following:

1. Two Sony HD video cameras.

   It was mentioned above that EVL had recently acquired two Sony HD Cameras, an HDR-FX1 and a HVR-ZIU. These two cameras are different cameras and they have different chipsets. That means that they process color differently. Color correction is a process that had to be explored both during video shooting, by adjusting color levels manually in the cameras and later on in post-processing.

2. No macroscopic lenses.

   The lack of macroscopic lenses due to financial constraints and time limitations required that the video content had to be acquired with the default lenses of the cameras listed in item 1.

3. Disney Black Stewart Projection screen to preserve stereo polarization.

   In general, lightly colored imagery is not well perceived visually in front of black screens. On the other hand, contrasted colored imagery enhances depth, which in turn improves the stereo experience.

A.4 Producing Hyperstereoscopic Video

FIGURE A.1: *MFA EV studio setup, Art & Architecture building, UIC, 2006*

A.4.1 Studio setup & Lighting: the Method of Trial & Error

Subject matter, aesthetics, and technical limitations, are the main parameters for deciding whether shooting will take place indoors or outdoors. For this project, background color was of importance for enhancing the perception of depth; this made control over lighting a critical matter. In addition, the distance calculation and alignment for the cameras, in order to achieve correct stereoscopic video were very critical. Of equal importance was the presence of video monitors in the production field. Since production depended on loaned equipment from EVL and on a student budget, the location of choice was indoors.

As a guideline on how to setup a studio space [Figure A.1], in regards to location of setup, lighting and backdrop, this artist followed and recommends the steps below:

1. Find a studio space: The current year the MFA, EV program had the opportunity of a shared studio space for the first time.
2. Explain to the rest of the group that utilized the space that you will be working in the space and experimenting, in order to avoid confusion.
3. Mess it up, setup, experiment, reconfigure [Figure A.2].
4. Repeat step 3, until satisfied.

As a final configuration the studio setup comprised:

- Four studio lights of a topology shown in Figure A.3.
- A backdrop of black velvet (the blackest black in order to provide contrast for stereo) stretched on 2 self-standing poles extended up to the ceiling and floor.
- 2 video monitors to continuously monitor the cameras' reception, color configuration, lighting and stereo limits.
- Two tables, where action would take place. These were partially covered with black velvet, and marked with masking providing visual cues for location of action.

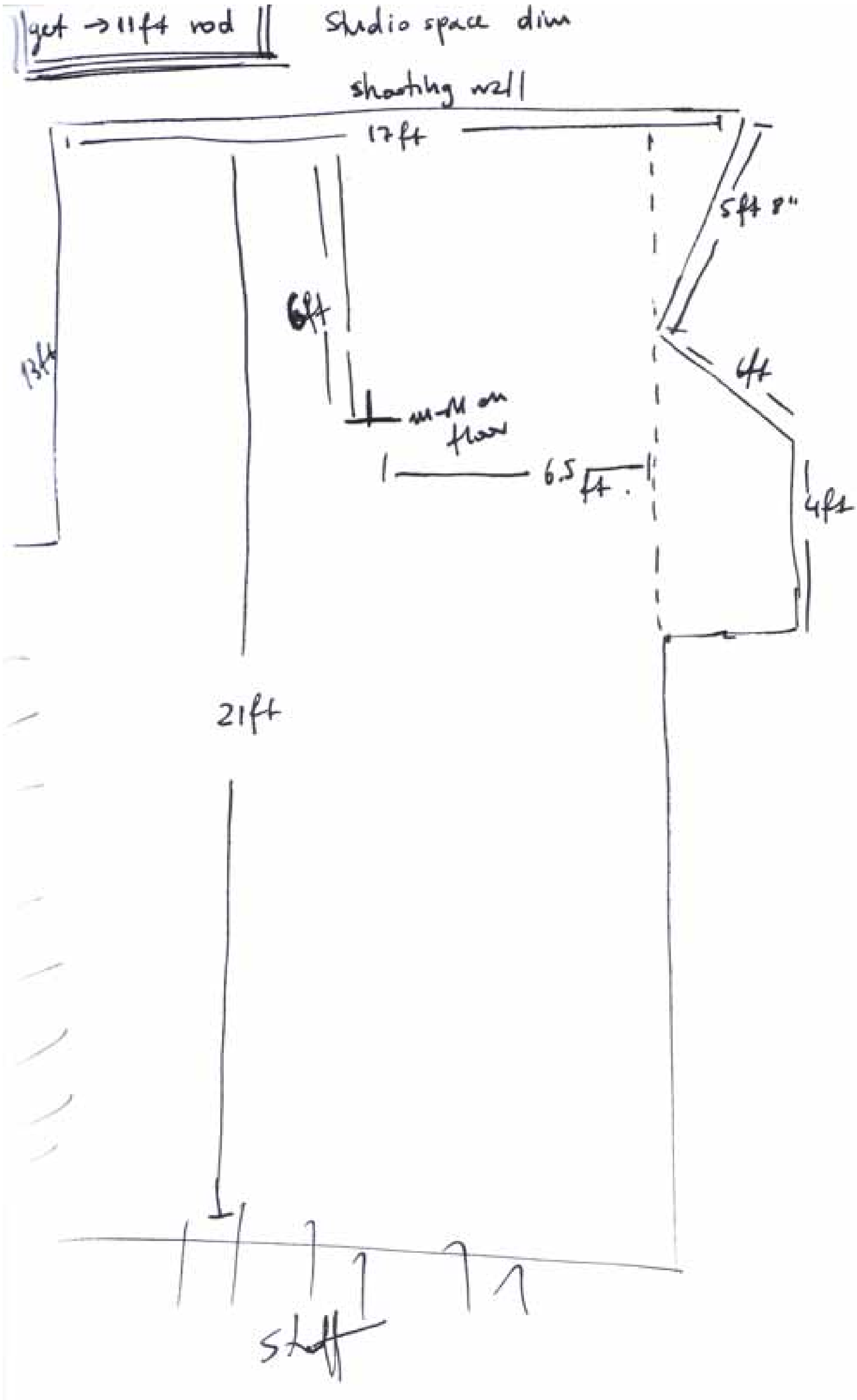

FIGURE A.2: *Sketch of MFA EV studio configuration, Art & Architecture building, UIC, 2006*

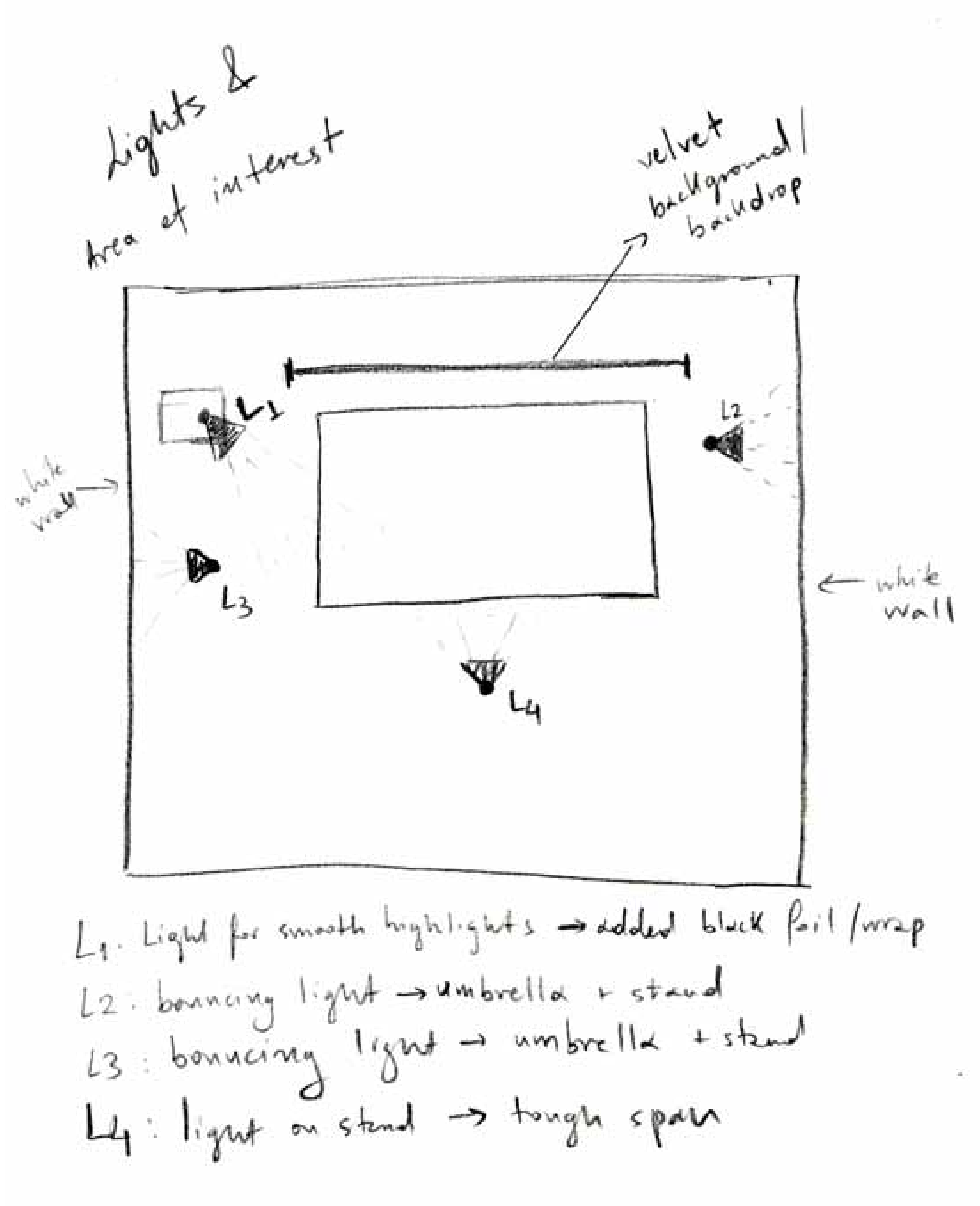

FIGURE A.3: *Topology of studio lighting, 2006*

A.4.2 Cameras, Tools & Equipment

The required equipment/checklist for the production of stereoscopic video is listed below:

- Two cameras, with identical lenses and as similar as possible in specifications. Shooting stereoscopic video requires the use of two virtually identical camcorders.
- Tripod.
- Accurate stereo base. A stereo base (a base that supports, aligns, and holds both cameras together in the desired distance) is critical. The base was constructed with high precision and accuracy in the Engineering Shop at UIC, with alignment pins as can be seen in Figure A.4 & A.5.
- Level.
- Plumb-bob.
- Measuring tape.
- Straight Laser beam.
- Electrical tape.
- Crayons to mark positions.
- Toolbox with screw-drivers, Allen wrenches, pliers, etc

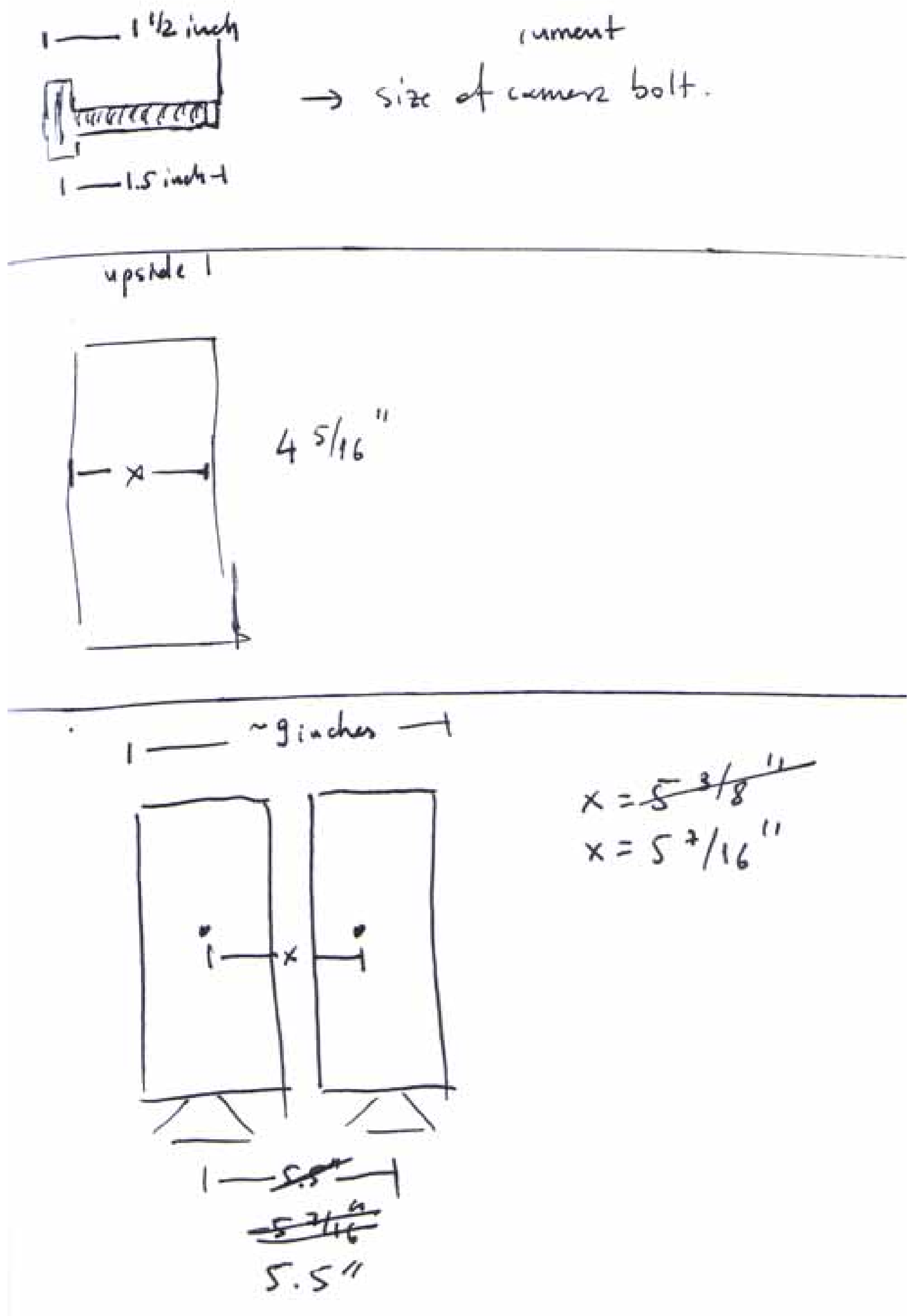

FIGURE A.4: *Measurements for stereo base, 2006*

FIGURE A.5: *Cameras, stereo base, bolts & level, 2006*

A.4.3 Alignment of cameras

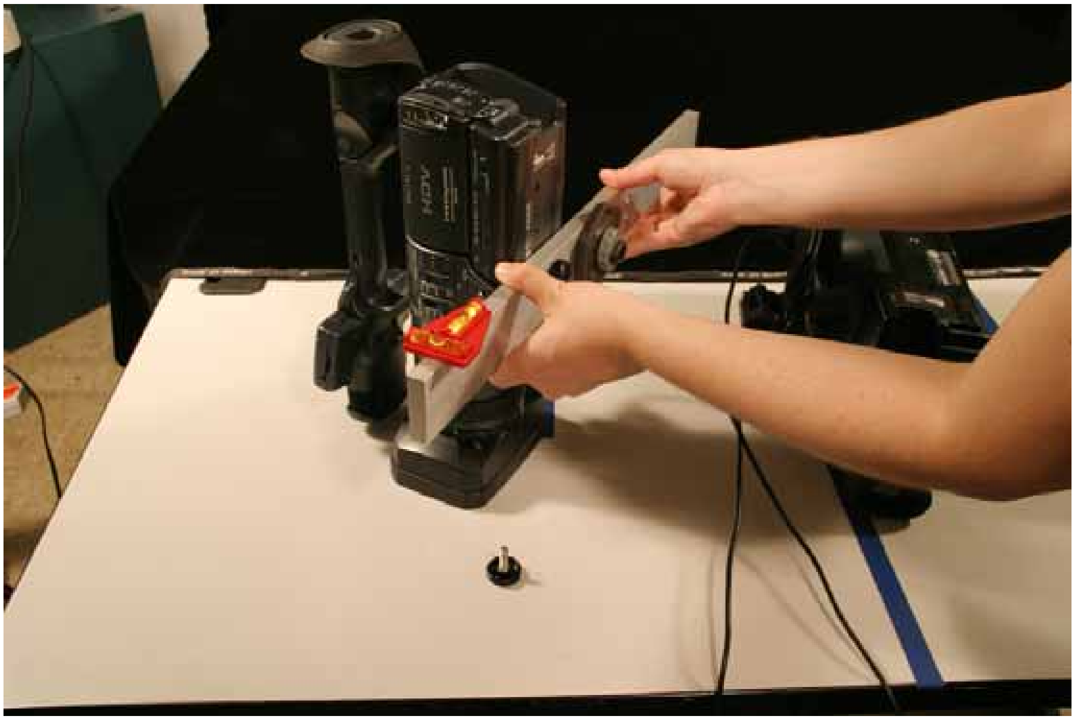

***FIGURE A.6:** Alignment of cameras on stereo base, 2006*

***FIGURE A.7:** Alignment of cameras on stereo base, 2006*

Mounting the cameras properly onto the stereo base was possible through the use of a level in order to avoid vertical parallax as shown in the figures above: Figure A.6 & A.7.

The stereo base with both cameras was then mounted to an already calibrated tripod (the head of the tripod is parallel to the floor) Figure A.8. The level ensured that the cameras with the stereo base were mounted parallel to the floor. In a different case, the tripod had to be calibrated and corrected.

FIGURE A.8: *Lock and level the stereo base with cameras on tripod, 2006*

FIGURE A.9: *Calculating the frontal plane for stereo video, 2006*

FIGURE A.10: *Calculating the frontal plane for stereo video, 2006*

FIGURE A.11: *Calculating the frontal plane for stereo video, 2006*

FIGURE A.12: *Calculating the frontal plane for stereo video, 2006*

FIGURE A.13: *Mask the monitors and mark the table to get the same content in both, 2006*

FIGURE A.14: *Stereo setup configured, 2006*

A.4.4 Camera Settings & Warm Balance

This artist's strong interest in film motion pictures influenced her decision to shoot the piece in a fashion that resembled cinematic motion and image quality; this allowed taking advantage of the features in the cameras' manual mode. The settings that were used are listed below:

- Cineframe 24 fps
- F-stop 3.1
- Shutter Speed 60
- Custom white balance, using Warm Cards - as shown in Figure A.15 & A.16 - in order to create warmer skin tones

Additional settings were adjusted individually for each camera, in order to render the resulting images as identical as possible. As can be seen in Figure A.15 the cameras interpret colors differently, therefore, extensive tuning had to take place prior to shooting. Gain adjustment, Neutral Density (ND), white balance, color level, cinematone, and skin levels were some of the factors that required individual tuning for each camera.

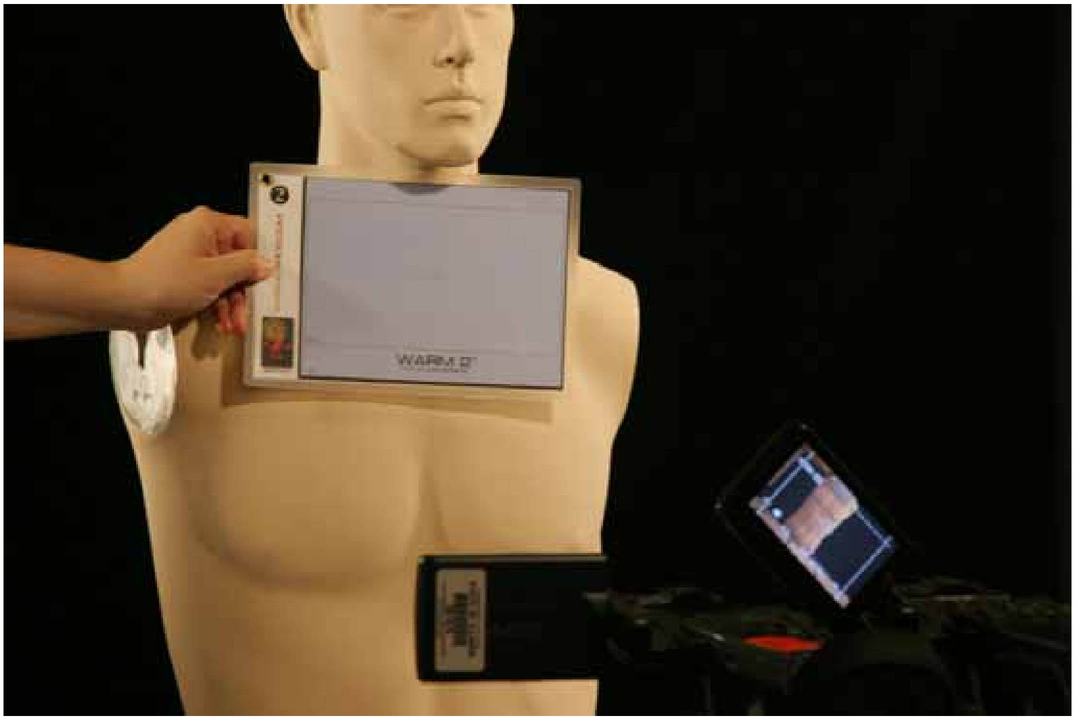

FIGURE A.15: *Custom white balance with warm cards for left camera, 2006*

FIGURE A.16: *Custom white balance with warm cards for left camera, 2006*

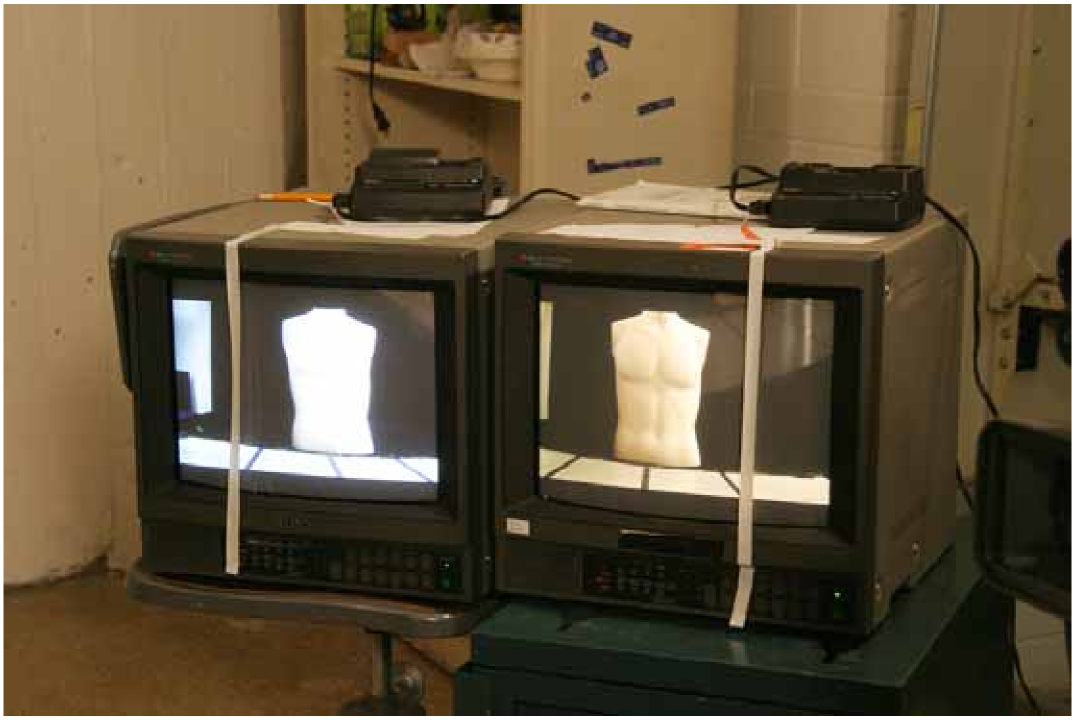

FIGURE A.17: *Difference in colors between two cameras, 2006*

A.4.5 Shooting

FIGURE A.18: *Configured studio setup for stereo video, 2006*

During the shooting process it is important to create visual and audio cues for the cameras at the beginning of each scene. This is a common procedure in traditional film and video productions, which allows sequence synchronization later in the editing process, when more than one camera is used.

In each scene the following have to be constantly monitored:

- Lighting of the scenes: since each scene is different, the lights have to be readjusted.
- The object(s) of interest should not perform movements in an area that is out of the depth of field of both cameras [Figure A.19]
- The object(s) of interest should not be closer than the frontal plane [Figure A.19].

Successful shooting of the stereoscopic video content was possible by using marks on the monitors (to check which part of the image is out of stereo) and the table (to check approximately the side limits for the object of interest). Constant checking of the monitors during the performance was also necessary.

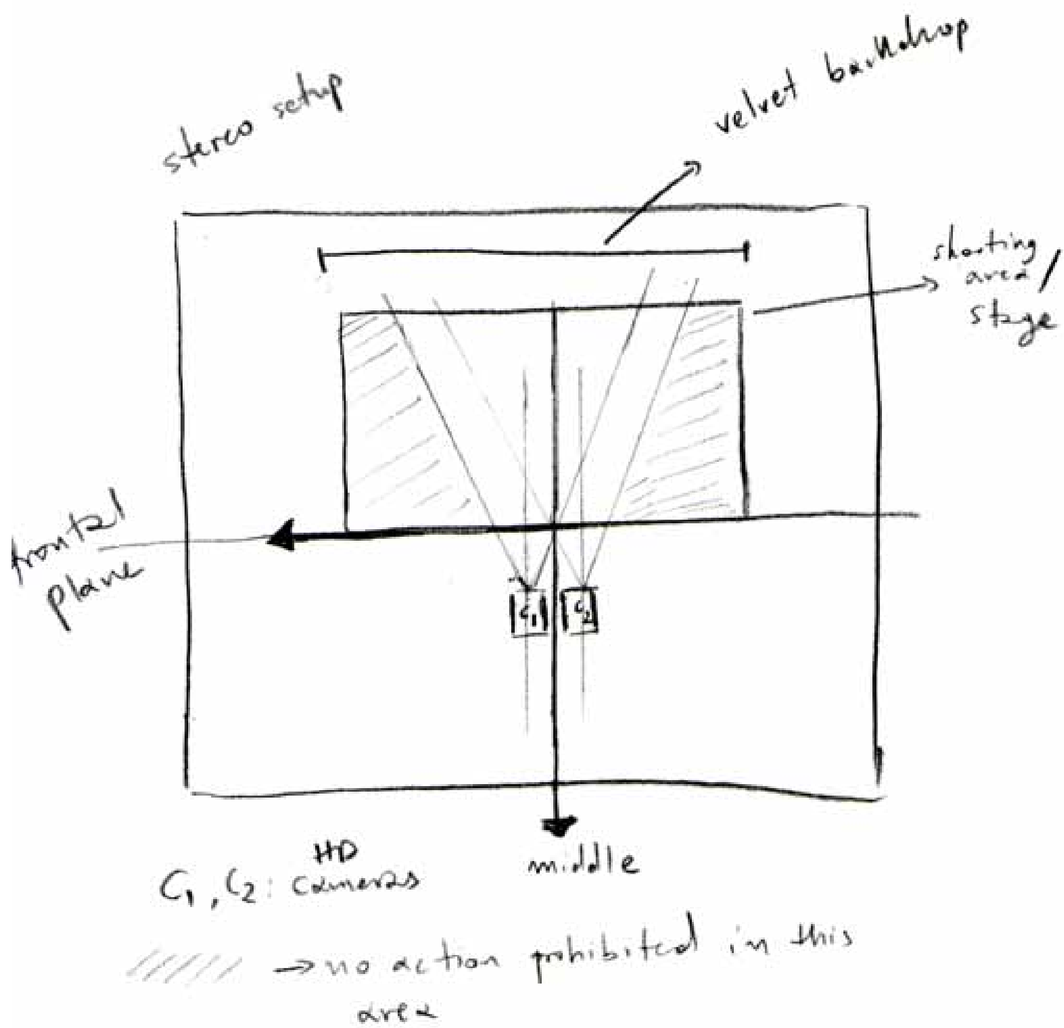

FIGURE A.19: *shooting field and frontal plane, 2006*

A.5 Editing

After each shooting, the material was reviewed and recorded on logsheets containing information of start and end times and comments for the scene. The logsheet technique is highly recommended and helpful in any video content, especially when one ends up with many hours of tapes. This technique helps the selection process of the content and the editing procedure.

The most important feature in editing for stereo video is synchronizing the two video captures. Since stereoscopic video implies shooting with two cameras, at the end of shooting there are two tapes: one for the left eye/image and another for the right. The two video sequences can be synchronized with the help of visual and audio cues that were recorded for each scene, much like in regular (non-stereo) film/video productions.

Once the two video sequences are synced, the editing procedure is similar to the monoscopic video editing procedure. The only difference in such case is that any treatment has to be made for both sequences at the exact same frame, so that right and left eye frames will correspond to the same content when played back simultaneously.

A.6 Exporting Video Sequence for Electro

Electro at the time of development can play back video in the form of a flipbook animation. This implies that the video sequences have to be exported as still image sequences. Later on, when ready to be played back in electro, they have to be converted to the "Raw RGB" format or to the compressed format of DXT. Current editing software does not export sequences in the "Raw RGB" format, therefore the images must be exported in some compatible image format (for example PNG) as an intermediate step.

A.7 Post Processing

A.7.1 Color Correction

It is important to mention that the cameras used for shooting were different, and they treated colors differently. During preparation of the setup, the cameras were calibrated as much as possible to resemble each other, however, in the end, the color temperatures were different. While testing stereo playback, the stereo effect was noticeably reduced, due to the difference in the color information. The images could not be fused easily. For this reason, the color correction technique was employed to shift the color temperature of the "cold" sequence to warmer tones. The correction was achieved in Photoshop using batch processing, with the help of Daria Tsoupikova.

A.7.2 Image Processing

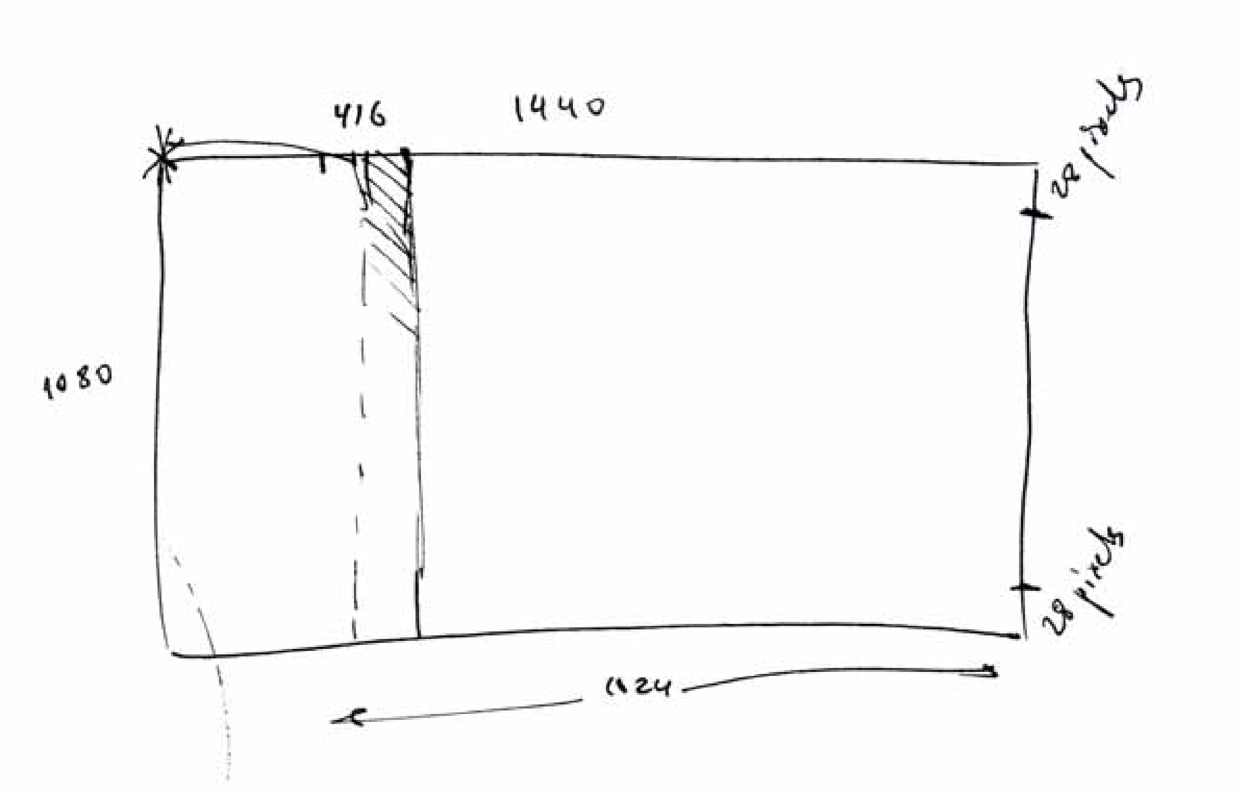

FIGURE A.20: *resizing of image from 1440x1080 to 1080x1080, 2006*

After color correction was completed, the images had to be processed for the Electro requirements. Using Image Magick software the images sequences were:

- Cropped, retaining only the part of the image on stereo field
- Converted to raw RGB format
- Resized to follow the requirements for the DXT format, (linear dimensions must be a power of 2)
- Compressed images to DXT format (using Robert Kooima's program)

Example of commands:

```
» mogrify -crop 1024x1024+416+28 *
» mogrify -format rgb -depth 8 *.png
» ../rgb2dxt -w 1024 -h 1024 *
```

A.8 Playback & Electro

Once color correction and image processing is completed the images are at a stage to be played back on Electro. As mentioned earlier, Electro plays back images as a flipbook animation. For this reason, images can be texture-mapped on a plane (or a mesh in this particular case) and played back in the required frame rate by texture mapping each frame on the plane (or mesh). As a final step, the images have to be aligned in Electro. Finally, the sequence and initialization of each grouping of pictures must be set.

B Skin Culture & Perspectives: Addenda

B.1 Skin & bioengineering research

- Apligraf® - a living bi-layered skin substitute
- Bertek pharmaceuticals - Biobrane® - Biosynthetic Wound Dressing
- Gottfried® Medical,Inc. burn garments
- Integra Life Science - INTEGRA® Dermal Regeneration Template
- Ioannis V. Yannas, MIT professor - developed the first artificial skin
- Lifecell - AlloDerm®
- Printable Skin: "Inkjet" Breakthrough Makes Human Tissue, Feb. 2005
- TransCyte™: Temporary Skin Substitute

B.2 Skin art

Individual artists that deal with skin issues are listed below alphabetically. In the case that the artists dealt with skin issues in a specific artwork, the piece is mentioned:

- Alba D'Urbano: Hautnah
- Ann Hamilton
- Azziz + Cucher (A+C)

- Bill Viola: Science of the Heart (1983)
- Charlie White | Joshua by Charlie White
- Christophe Luxereau: Avatars
- Daniel Lee: Manimals
- Elinor Carucci
- Ernesto Neto | Ernesto Neto at the Fabric Workshop & Museum
- Eva Hesse
- Fakir Musafar
- Gary Schneider: Genetic Self-Portrait
- Jake and Dinos Chapman
- Jill Scott: Taped, e-Skin
- John Coplans
- Joe Davis
- Kevin Marwick: body embedded chips - Project Cyborg 1.0, Project Cyborg 2.0
- Lee Mingwei: The First Human Male Pregnancy
- Leora Farber - ARTTHROB: Four Minor Renovations: Revamp, Refurbish, Retouch, Refine, 2000 Video | Leora Farber - Jibby Beane Contemporary London
- Margi Geerlinks
- Marina Abramovic: Cleaning the House Performance, Thomas Lips, Breathing In/Out
- Micheal Rees
- Mongrel | Tate Collection: Uncomfortable Proximity project | Mongrel site
- Orlan
- Patricia Piccinini

- Stelarc
- Sylvia Rigon: Venus Villosa
- Thecla Shiphorst: Bodymaps: Artifacts of Touch
- Wendy Jacob: Squeeze Chair Lounge, Columns
- Ulay: Tatto Trasplant, Retouching Bruises

Exhibits and groups that work with skin:

- Anatomical Travelogue - visualization artistry on medical images
- Gene(sis): Contemporary Art Explores Human Genomics
- Second skin: an exhibit at the Cooper-Hewitt, National Design Museum

Projects:

- Skins of Intimate Distance: A collaborative research project involving architects, designers and installation artists - Melbourne, November 2003

Virtual Reality and Gaming:

- Avatars – the alter ego of the digital realm

B.3 Skin surfaces in design & architecture

- Advanced building technologies, energy conservation (ex. Gotz Headquarters in Wurzburg (Germany), Commerzbank Headquarters in Frankfurt (Germany)), GREEN architecture and sustainable design, photovoltaic systems, double-skin façade buildings (ex. European Parliament in Strasbourg, Potsdamer Plaza in Berlin, Aurora Place in Sydney)

- Carla Murray & Peter Allen: TechnoLust
- Greg Lynn Form: Skin, Fold, Blob Architecture, Embryonic House (fluid architecture)
- Herzog & de Meuron Architecture group: Allianz Arena in Munich (Germany), Beijing Olympic Stadium proposal
- Jurgen Bay: Kokon/Covered series
- inter_skin, by Stahl Stenslie
- Latex clothing, such as leotards, bodysuits, stockings, gloves, undergarments. IT iscommon in fetish fashion and it is skin-tight.
- Marcel Wanders: Sneeze, Egg, Sponge Vase
- Matthieu Manche - Fresh series of garments
- Prophylactic skins for gadgets, for example, iPod skins
- Skins as computer interfaces that can be downloaded from the Web, allowing the customization of interfaces for computer applications and software.
- Tonita Abeyta: Sensate, 2000-2001 - Latex garments with and without built-in male or female condoms (Manufacturer: California Medical Innovations)
- "Water Cube" building, National Aquatics Center, China

B.4 Skin-like materials

- Aerogel, Jet Propulsion Laboratory: used to insulate Mars Pathfinder
- Barrisol stretched ceilings
- Calcite Alabaster (often termed Oriental alabaster) and Gypsum Alabaster, used for figure-sculpture.
- IDEO fabrications for Eleksen (ElekTex fabric): smart fabric exploration - it is a conductive fabric whose entire surface can sense the location and pressure of human touch.
- Smartex, Woven smart system, Electrotextile, fibers and fabrics
- PINK INC. tension fabric structures
- latex, rubber
- membrane of polyurethane (easily applicable by spray gun or paintroller)
- soft polyurethane, silicone
- **s**pandex, elastane fabric - Lycra

B.5 Skin in films

- 2001: A Space Odyssey (1968), by Stanley Kubrick
- Alien (1979), by Ridley Scott
- Aliens (1986), by James Cameron
- Alien3 (1992), by David Fincher
- Alien: Resurrection (1997), by Jean-Pierre Jeunet
- Blade Runner (1982), by Ridley Scott

- E.T. the Extra-Terrestrial (1982), by Steven Spielberg
- existenZ (1999), by David Cronenberg
- Sleeper (1973), by Woody Allen
- Star Trek: The first Contact (1996), by Jonathan Frakes
- Solaris (1972), by Andrei Tarkowski
- The Belly of an Architect (1987), by Peter Greenaway
- The Pillow Book (1996), by Peter Greenaway
- The Silence of the Lambs (1991), by Jonathan Demme
- Videodrome (1983), by David Cronenberg

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Artist bio

Helen-Nicole Kostis is a media artist who works with video, virtual environments, interactive installations, physical and digital sculpture. She is captivated by the creation of new, synthetic worlds, immersive bodily experiences, the combination of virtual and physical realities and the discourse that is generated by their coexistence. Born in 1976, she lives and works in Chicago, USA. She has obtained her BS in Mathematics (1998) from the University of Ioannina, Greece, her MS in Computer Science (2002) from the University of Illinois at Chicago and her Master's in Fine Arts (2006) in the Electronic Visualization (EV) of the same institution. She has exhibited at Version>03::Digital Arts Convergence Museum of Contemporary Art in Chicago (2003), Electronic Imaging Science and Technology, SPIE (2005), AG-Art performance "Loose Minds in a Box" (2005), WIRED magazine NextFest (2005), SIGRRAPH05 - Emerging Technologies Access Grid Art (2005), IGRID (2005), Super Computing Global – SC05 (2005).

Thesis website

http://www.evl.uic.edu/eleni/thesis