Fooling Ourselves

Topics and Design Strategies for Media Architecture, Integrated Media, and Composite Reality

by

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Abstract

The rapid expansion of new media technologies is exacerbating inherent flaws embedded in the common multimedia display, or *screen*. As of 2015 the average American spends more time perceptually engaged with virtual content via screens than with the real world, with adverse effects. The current landscape of engagement with the virtual world, and virtual engagement with each other has lead to increased mediation, isolation, and dissociation that threatens how society functions. To counteract this trend, we should be making more of an effort to integrate the virtual into our natural, shared environment, and to create multimedia experiences that *physically* bring people together.

Architecture is particularly well situated to tackle the integration of the virtual into the built environment. Such an endeavor constitutes a new subcategory of architecture: media architecture, which synthesizes physical design, content design, and communication theory.

This subject matter is explored with the aid of various video based experimentations and artistic explorations. As a result of these experiments and explorations this thesis also proposes a number of design strategies for creating integrated media, including a materialist approach for creating virtual content that is more tethered to reality. Throughout, this thesis seeks to interrogate the eternal rift between the world in our heads, and the world in which we find ourselves, between imagination and reality.

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To all of my loving and endlessly supportive families.

FOOLING OURSELVES

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Introduction

Over the last century, virtual content has colonized our homes and cities with screens; silver screens, television screens, flat screens, and touch screens. These two-dimensional rectangular displays now range in size from tiny smart watches to towering media facades.[1] As of 2015 the average American spends more time perceptually engaged with virtual content than with the real world—almost ten hours per day, totaling nearly 58% of waking hours. [2] As such, it is now safe to say that media displays are no longer just colonizing our homes, streets, and cities; they have overtaken reality, and their domain will likely increase as virtual reality headsets such as the Oculus Rift are poised to widen the more pressing rift occurring between people and the hard reality of the physical world. The problem is, these screens and their content do not just *augment* our surroundings, they also *disrupt* them by creating virtual visual pocket realities that challenge how our minds are wired to understand reality.

Rather than continuing to aid the virtual world in supplanting our natural physical environment—to which our entire sensory physiology has been tuned over millions of years of evolution—we should be doing more to engineer technologies that render digital

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[1] The average American gets 6.8 hours of sleep according to a Gallup study conducted in 2013. Jeffrey M. Jones, "In U.S., 40% Get Less Than Recommended Amount of Sleep" (2013), accessed December 20, 2015, http://news.gallup.com/poll/166553/less-recommended-amount-sleep.aspx.

[2] In this case visual attention constitutes "engagement". Figures on aural attention are unknown and likely less easily quantified, as synthesized aural conditions are more easily and therefore more frequently superimposed. Even less can be said at this point about the breakdown between conscious engagements in external perception versus internal thought. Engagement statistics from Mary Meeker, "Internet Trends 2015 v3," (Presentation in Kleiner Perkin Caufield Byers, May 27, 2015), http://www.kpcb.com/internet-trends.

media in ways that more closely resemble the natural world. Of course there are risks in presenting synthesized imagery in such a way that makes it perceptually indistinguishable from reality, and there should always be boundaries, but we can do better than the black demilitarized zone of the bezel. We must recognize our perception as a shared, base condition of reality in which all things—synthetic or otherwise—present themselves in full spectrum to the human sensory apparatus, and can thus be more deeply processed and understood both by individuals, and communities.

New mediating technologies can augment the ways in which we sense reality, extending our perception across time, space, scale, and even into new dimensions. However, some forms of media threaten and compromise our most basic natural senses, while others fail to translate to the vast majority of the human population, which is lacking in specialized media literacies. As a result, many means of knowledge production have become exclusionary, requiring significant translation or mediation, leading to a population that distrusts hard data.

Figure 1.

Black Plane I (iter. 1, Nature vs Nurture)
2017
Joshuah Jest
Projection-augmented sculpture

The third sculpture in the *Field Studies* series, entitled *Black Plane I*, critiques contemporary digital media and its capacity for compromising societal prioritization.

In a field of shag carpeting, reminiscent of the 60's in which the television first installed video media into the daily lives of Americans, three figures wander amid the tall grass in which our evolutionary ancestors hunted and were themselves hunted. Cast directly from their contemporary media-laden lives, they reflexively rely on technology that still blinds them to matters of real concern.

PART I

The Nature and Latent Potential of the Display

We currently use screens as portals to peer into the synthesized realm of information and constructs, but at the cost of detaching ourselves to some degree from our natural surroundings. This detachment is damaging in two significant ways: first, it privileges the virtual over the real. Secondly, distancing ourselves from reality forces us to base our understanding of reality on flows of information that are subject to mediation and influence.

A largely unexplored potential of the display lies not in providing a portal through which the viewer can enter a virtual environment, but one through which the virtual can enter the viewer's environment, reversing the paradigm of immersion, wherein the viewer enters a competing sensory landscape by leaving the real world partly behind, and instead allowing digitally synthesized information, images, and phenomena to enter into *our* space. Here, in our natural surroundings, free of the language of constructs (symbols, icons, text), the tell-tale signs of digital displays (bezels, rectilinear boundaries, limited dimensionality, pixels, unnatural brightness and color), and beholden to at least *some* laws of physics (momentum, temporal and spatial continuity), virtual content is not immediately dismissed by the mind as immaterial signal to be left to higher brain function, but as an indication of material consequence. Staged as such, virtual content can be perceived by a wider array of human senses and processed more deeply by the hindbrain, expanding the affective range available to all multimedia applications. This means heightened attention and a deeper sympathy on the part of the individual, as well as a greater emotional provocation, understanding, and retention of content.

Utilizing the aforementioned approach to design has two beneficial consequences: first, it can counteract the negative social and psychological effects that result from the isolating nature of contemporary on-demand media, decreasing the mental processing required to sustain perception in two separate environments; and second, it can restore a sense of the immediate, including a stronger sense of self and community for individual users. These outcomes are achieved simply by taking steps to ground displays and their content to the physical world as touched on throughout this text. When deployed at architectural scale or in an urban environment, media installations with an expanded affective range can have similar restorative effects on groups of individuals, as well. Such media architecture installations can also cultivate localized social feedback loops when properly staged and responsibly curated, enabling communities and cultures to develop and strengthen localized or global identities more rapidly, and to do so in real space, independent of corporate or government-controlled media outlets [Figure 4]. Such a system of localized architecturally-scaled media would constitute a *superarchitecture*; an ideally democratic affective infrastructure to compete with television and the internet, but with the physical presence and place-making capability of architectural persistence. [3]

What distinguishes the virtual from the real? Is it the square screen of a digital display that identifies the contents as synthetic? What if the display was round or irregularly shaped: would its contents still be easily identified as synthetic? Is it the flatness of the content that gives it away? What if the screen warped and allowed its two-dimensional media to traverse in the third dimension of space? Is it the unnatural

[3] Sylvia Lavin, *Kissing Architecture.* (Princeton, NJ: Princeton University Press, 2011), 4.

[4] Noël Burch and Ben Brewster, *Life to Those Shadows.* (Berkeley: University of California Press, 1990), 2

[5] See Harry Hoyt, *The Lost World* (1925).

smoothness of the black mirror? What if the screen had a natural mossy texture? Would the brightness and color of the content still distinguish it from the faded colors of the natural world? What if the brightness and color of the content were muted to match the surroundings? Would the black plastic housing, buttons, indicator lights, and cables nearby still denote the presence of synthetic images? What if they were done away with too?

In short, what are the signifiers we use to distinguish digital video and images from reality? Is it possible to eliminate every signifier? What would be left?

Figure 2.

A Tale on Textile – The Colony
2013
Joshuah Jest
Projection-augmented sculpture installation
Mixed-media sculpture provided by artist Svenja Keune

The Colony is an installation that demonstrates a number of ways in which the signifiers of virtual content can be mitigated, or eliminated entirely. The installation includes the physical sculpture (courtesy of artist Svenja Keune), an accompanying animation, and the physical staging of the sculpture, including a custom-built pedestal and suspended hood that houses three projectors, speakers, and a rotting shrimp.

First and foremost, the installation presents Keune's textile and ceramic sculpture, which is oddly organic in appearance, as a live specimen rather than a work of video art. The sculpture is displayed horizontally inside of a pseudo-scientific open terrarium inspired by the dinosaur hatchling incubators from *Jurassic Park* (1993). In presenting the sculpture in this way the installation subverts the convention of standard screen orientation.

Typically, people are accustomed to media—particularly video and digital content—presenting in the vertical plane. Televisions are hung on walls vertically, computer screens are generally oriented vertically, movie theaters screens are oriented vertically, even static media like paintings and advertisements are predominantly presented vertically, with their fronts aimed at the viewer. *The Colony* is presented horizontally. Its front is up, not aimed directly at the viewer, and thus avoids a common signifier of video or digital media.

The installation consciously avoids adopting the rectangular frame and aspect ratio of a typical display. The boundary of the rectilinear shape of the display is contrived, a product of technological innovation and economy. It has nothing to do with the object of focus, and is therefore largely ignored. The design of the pedestal and hood prioritize displaying the focal sculptural object, which rests at the center of a circular habitat area. Neither the square base nor the circular area are stretched in order utilize the entire rectangular area covered by a projector. Instead the projectors are positioned, and their lensing adjusted to cover the necessary areas of the sculpture. Where most video content would seek to utilize every pixel within the frame of the display, *The Colony* utilizes only the pixels within the natural frame of the presented objects, ignoring the screen space that falls beyond.

The two primary projectors are placed in the hood, and shine downward onto the sculpture as one would expect a normal light to behave. Each of these two projectors have different throw angles, allowing one projector to cover the entire habitat area with larger pixels, while the a third projector provides higher pixel density to key areas on the sculptural object.

A third projector lights the sculpture and the surrounding habitat area, which are mounted on transparent plexiglass, from below. The back projection is so that some light source will remain within the sculptural object even if a viewer waves a hand over the sculpture and interrupts the overhead projections.

The pre-rendered animation for the object lasts approximately 11 minutes in duration, and is designed to loop. In fact the whole narrative of *The Colony* relies on the loop. The animation depicts an uncanny terrestrial colony of mollusk-like creatures. After six of so minutes of the creatures subtly moving their mouths under a blistering white light, the fauna around them slowly becomes lush. Out of the lushness comes a single red pixel, which crawls around the sculpture before nesting, infecting, and spreading across the colony like a virus. The infection drives the colony into hyper-activity, and eventual exhaustion, after which it settles back into the original blistering white light until the cycle begins again. The action of the narrative ramps up slowly, designed to incrementally build and disperse an audience ad infinitum.

The rotting shrimp adds a distinctive scent of the sea.

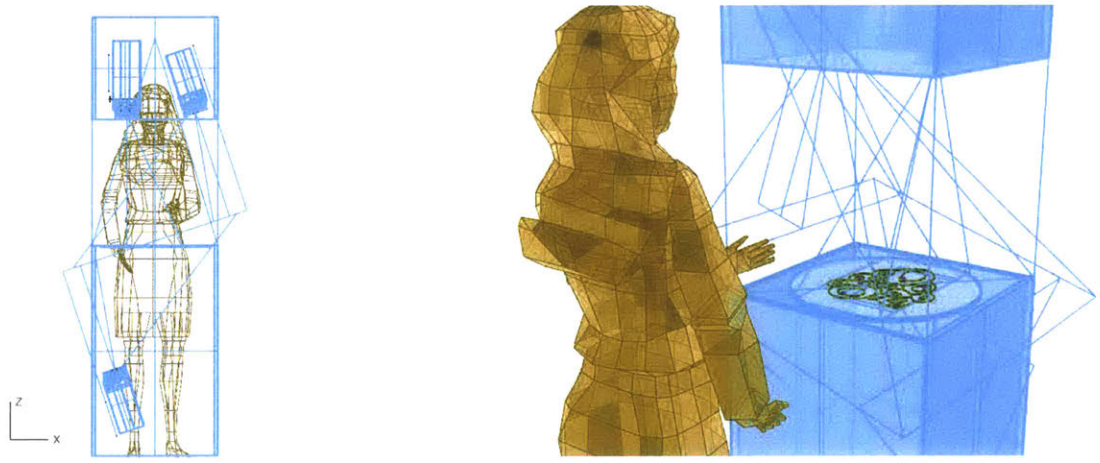

Figure 3.

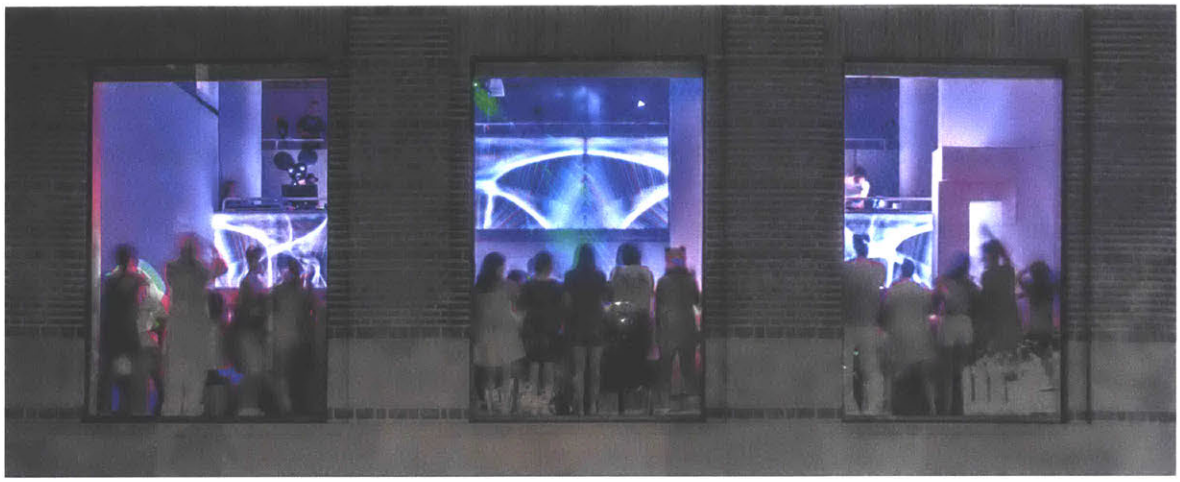

Figure 4.

Architectronica
2012
Joshuah Jest
Site-specific multi-channel projection installation and exhibition

A reoccurring projection mapping installation at Rice University School of Architecture that fostered an accelerated a community of student-driven art and technology.

Content is created and curated by students, and serves both to entertain and inform. The featured reoccurring installation animates the distinctly barren interior of the architecture school with student-made media (data visualizations, maps, computer simulations, poems, renderings, drawings, documentary videos, high speed footage, etc.) via a multi-channel video projection system that synchronizes the content to the beats of live student-created music.

Discontinuity in Media: Death by a Thousand Cuts

Film, and later video technology made it possible to virtually recreate moments, but the supporting technologies introduced points at which the supposed objectivity of mechanical interpretation of reality could be manipulated. To early moviemakers the additional mediation offered ways to entertain and perplex by exploiting the visual interpretation habits of a public that had yet to develop an understanding—or literacy—of this new medium. Early exploitations echoed the over-the-top vaudevillian theater in order to maintain legibility across the restrictions of a developing medium, but as the medium matured, so did the techniques of exploitation, building on top of foundational practices of discontinuity such as the 'cut' that have since crystalized into the what Noël Burch refers to as the Institutional Mode of Representation. [4] In his book *Life to Those Shadows*, Burch argues that as a result of repeated exposure to television and cinema at a young age we internalize a rather unnatural language of sequential shots. Part of this media literacy is a blindness to cuts. What were once recognized as jarring discontinuities in time and space, are now firmly established in all video content.

The mechanics of the medium of film offered control of two significant aspects of reality via various points of mediation: time and space.

[4] Noël Burch and Ben Brewster, *Life to Those Shadows.* (Berkeley: University of California Press, 1990), 2

Time

The virtual transcendence of time is film's defining achievement. While photography was merely a mechanical refinement to the virtual pictorial image practices established by painting, film broadened the territory of the virtual by extending its modality into a third dimension—time. Film offered a number of ways in which time could be manipulated.

First, it could be relived. Much like a photograph could capture a single moment, film could capture a progression of moments, which could then be recreated *later*; at a different time; any *time*, in addition to any *where*. Film enabled people to witness (virtually) events of the past, and for events of the past to (virtually) exist in the present. [5] Virtually, time was no longer single continuum; film made time discontinuous, giving the people the power to choose what continuum to make available by way of choosing which historic events were recorded, reprised, and when reprisals should occur.

Second, manipulating the rate at which individual film cells were exposed could control the speed of time upon re-presentation. Varying the frame rate made it possible to expand or contract time, allowing for the perception of timescales previously inaccessible to human experience. [6] Decreasing the frame rate allowed for the lowering of temporal resolution, enabling the viewer to experience time on a macro scale in what would come to be known as *timelapse*; while increasing the frame rate increased temporal resolution, enabling the viewer to experience time on a micro scale in what would come to be known

[5] See Harry Hoyt, *The Lost World* (1925).

[6] See George Méliès, *Carrefour De L'Opera* (1897).

as slow motion. [7] Virtually, the cadence of time was disrupted, giving some the power to control the timescale at which the *Recreations of Reality* were displayed, and thus the power to influence how reality was subsequently perceived.

Third, film could be cut. The film camera was capable of capturing an additional essence of reality by transcoding a sequence of images into a linear material format; expanding the terms of what could be made virtual, but by reducing reality to a material format subject to physical manipulation. Unlike time on a human scale, filmstrips have a start, and an end. They can even be looped. Individual film cells can be separated. The virtuality created by film can also be cut and spliced. Dull moments can be removed, distilling the dramatic, the shocking, and the spectacular. Almost reflexively, *The Industry* sacrificed film's approximation of reality in service of emotional manipulation offered by narrative and spectacle. Over the past one hundred years, the virtuality of film suffered a death by many more than a thousand cuts. With contemporary films, such as *Mad Max: Fury Road* clocking in with an average of 22.7 cuts per minute for a grand total of 2,700 cuts over its two-hour runtime, most people don't even notice the near incessant breaks in continuity. [8] Because viewers are inundated by constant re-contextualization, their only concern is for the now. [9]

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[7] Judy Mitoma, Elizabeth Zimmer, and Dale Ann Stieber. *Envisioning Dance on Film and Video.* (Florence: Taylor and Francis, 2013).

[8] Yvonne Festl, "MAD MAX: FURY ROAD." *Cinemetrics*. October 27, 2015, accessed May 5, 2018, http://www.cinemetrics.lv/movie.php?movie_ID=18994.

[9] Neil Postman, "Now This," *Amusing Ourselves to Death: Public Discourse in the Age of Show Business.* (New York, NY: Penguin Books, 2006), 99-113.

Space

As with previous media, such as painting and photography, the two-dimensional content of each frame of film was subject to manipulation. As film—unlike painting—is a direct index of what is in front of the camera, the easiest way to compose a frame is to move the camera to frame reality. Like photography, the filming apparatus was mobile, so the vantage point could be anywhere accessible to a camera crew. The ability to capture and recreate moments from anywhere quickly became a draw for early films, such as the Lumièr brother's *The Pyramids* (1897), which featured sights from a far-off land. Just as film could virtually unite previously disparate moments in time, it could also virtually unite previously disparate spaces, such as a movie theater in Paris and the pyramids in Egypt.

Film also allowed for the manipulation of space within the screen itself. What substantiates the illusion of motion in film, or digital video is continuity between subsequent frames. Each frame can be slightly different than the next, and the persistence of vision will result in the perception of smooth motion. This phenomenon requires continuity between sequential frames. However, it does not require continuity of *all* things in frame. By utilizing the aforementioned cutting technology and the painterly manipulation of individual film cells, the continuity of a scene could be maintained while the continuity of individual objects could be disrupted, resulting in the degradation of the laws of reality we lovingly refer to as movie magic. The medium of film enabled entertainers to depict scenarios that were impossible in the real world, such as in *Un Homme de Têtes* (The Four Troublesome Heads) (1898) by George Méliès, which depicts a number of live disembodied heads.

Spatial tricks of the camera also allowed for the manipulation of the perceived scale of objects. Films like *King Kong* (1933), and later in *Tarantula* (1955) depicted building-sized creatures, capitalizing on the novelty of juxtaposing objects of disparate scales made possible by film.

Figure 5.

Cubic Microscope
2016
Joshuah Jest
Multi-channel multi-display live microscopy apparatus

The Cubic Microscope is an experimental multi-channel, multi-dimensional live video capture and playback system designed to utilize the spatial discontinuity created by the microscope to situate microorganisms at a human scale. The apparatus uses four live video feeds to capture organisms as seen through the translucent walls of a sample chamber in order to retain qualitative information that is typically lost in the dimensional compression imposed by two dimensional video displays. The appearance of the sample chamber walls are then projected in real-time onto a larger four-channel display cube, accurately recreating the appearance of the sample chamber and the organisms inside, but at a much larger scale.

The apparatus was used in 2016 to display water samples from the Boston area, which included small shrimp and other microscopic creatures. Viewers were disinterested in the water sample at first, but upon seeing the creatures enlarged to the size of puppies viewers returned to the sample with newfound curiosity and concern.

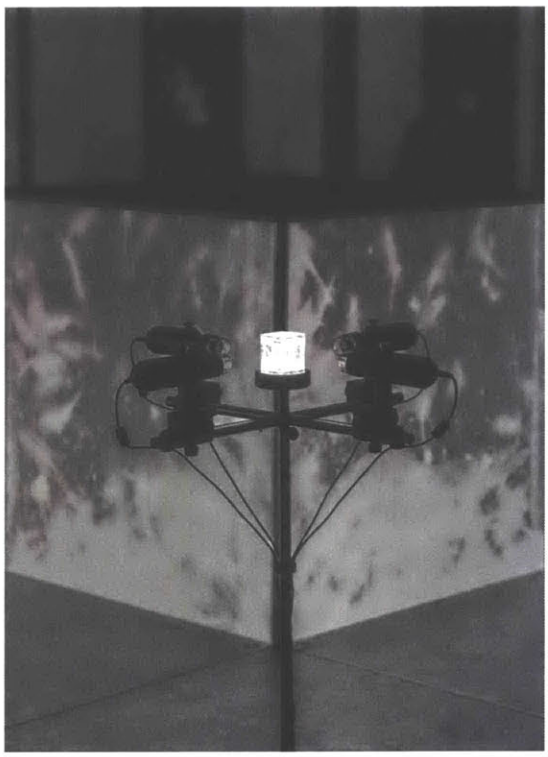

Figure 6.

Founded on Fake

By undermining time and space modern cinema departed substantially from reality in favor of creating both spectacle and narrative. The sacrifices of time and space are seen for their value in facilitating the virtual—a world without limitations—but again, this value comes at the cost of a fundamental separation from the truth and materiality of reality.

Though film maintains a degree of objectivity outside the realm of cinema, providing scientists and militaries with observational data, the same subjectivities of time and space still introduce problematic discontinuity; although to a lesser extend, e.g., the temporal delay between a drone and a commanding officer. Unfortunately the landscape of video media is not made up wholly of groups that either overtly exploit these discontinuities (such as for entertainment purposes publically seeking fantasy) or covertly minimize these discontinuities (such as for military endeavors privately seeking truth). In between there are plenty of groups that covertly exploit these discontinuities.

The same discontinuities that serve the overt virtualities of Hollywood spectacle and narrative can also serve the covert virtualities of political spectacle and narrative. In fact, the media has a rich history of exploiting subjective media coverage, or a lack thereof to exercise control over the public's perception of reality. Today, the news landscape is comprised almost entirely of coverage of what Daniel J. Boorstin refers to as pseudo-events, or coverage of non-events which both satisfy the public's supposed unquenchable thirst for new information, and serve to strategically overwhelm and overwrite significant events [Figure 7] which government or news outlets may be accountable to cover but

inclined to suppress. [10] This is achieved via the aforementioned exploitation of time, by which it is possible to alter the continuum of time to facilitate a narrative. The trick is, a news agency must not overextend its subjective agency. It must first ensure the virtuality it constructs closely approximates reality before allowing for politically useful departures thereof.

Every outlet supplies a healthy majority of reliable, uncontested facts in order to establish credibility; it will rain today, it will not rain tomorrow, today is mothers day, traffic is bad, people are buying presents for their mothers. Then, once credibility is established, the fundamental discontinuities of video media can be exploited. *Now... these random facts; people are having less children than they used to, and a woman died suddenly in freak accident. Now... a word from our sponsors about gift cards and flowers.*

To further blur the boundaries between what is virtual and what is real, news agencies such as those owned by the Sinclair Broadcasting group supply more literal hand-holding, offering opinions on stories and taking advantage of the power of co-attendance. Broadcasts take advantage of the fact that "adults are more likely to engage in elaborative processing of an object, or encode information in relation to a broader range of existing knowledge structures, when that object is believed to be co-attended with one's social group" by feigning the likeness of a social group within a broadcast by hiring "likeable" and "respectable" newscasters. [11] Viewers are more likely to adopt a behavior (including

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[10] Daniel J. Boorstin, *The Image: A Guide to Pseudo-Events in America.* (New York, NY: Vintage Books, 2012). See also *Optical Opt-Out*, a project that uses the technique of inundation to nullify Facebook's facial recognition software. 30.

[11] Garriy Shteynberg, and Evan P. Apfelbaum. "The Power of Shared Experience: Simultaneous Observation With Similar Others Facilitates Social Learning." *Social Psychological and Personality Science* 4, no. 6 (2013): 738-44. Accessed April 9, 2018. doi:10.1177/1948550613479807. 1.

viewpoints) of people with whom they closely identify or respect. [12] Virtual co-attendance also works most effectively in the absence of conflicting real-space co-attendee, so this sort of influence works best on isolated individuals.[13]

Figure 7.

Optical Opt-Out
2016
Joshuah Jest
Anti Facial Recognition Environment

Just as broadcast media overwhelms the public with pseudo-events to obscure or otherwise hide more important events, this piece uses the technique of inundation to nullify Facebook's facial recognition algorithms. The method can be used to create environments where people who do not wish to be identified or tagged in photos can relax. To achieve this the system bombards the visual environment with facial features, resulting in a complete failure of the facial identifying systems.

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[12] Garriy Shteynberg, and Evan P. Apfelbaum. "The Power of Shared Experience: Simultaneous Observation With Similar Others Facilitates Social Learning." *Social Psychological and Personality Science* 4, no. 6 (2013): 738-44. Accessed April 9, 2018. doi:10.1177/1948550613479807. 1

[13] See "Individualizing Media: Maximizing Mediation" in Section II. 44.

Part II

Benchmark of Human Experience

In reality, there is always room for more. Our biological senses are only capable of sensing a limited slice of the universe that surrounds us. Lights become too bright, sounds too loud, objects too tiny. The universe carries on at speeds and intensity beyond the grasp of our naked senses, but in our effort to create a composite reality, we do not have to make an exact copy of our world. We cannot fool God. We only need fool ourselves. The question is, to what extent?

The following is a personal experience, one I revisit frequently for inspiration and for more utilitarian purposes. In working with various technologies that claim to recreate the real, I often use this experience as a kind of test subject, evaluating a given technological medium or installation design according to which elements of this experience it can accurately recreate.

> My first summer break from college was exceptionally boring. Returning to suburbia after the freedom of college was as stifling as the Florida humidity that deterred any plans of venturing outdoors during the daytime. The nights however, were more welcoming. One night, desperate for a unique and artful experience, I convinced two of my closest friends to sneak into a beach at a national memorial after dark for some light-painting photography. Fort DeSoto's expansive and tide pool ridden beaches offered a minimal, elemental, yet richly textured monochromatic backdrop perfect for absorbing the light and colors of the neon lines produced by waving colored flashlights and sparklers around during a long-exposure photograph. We parked a bit outside the park entrance, loaded up our

gear, and made our way down the unlit park road. Eventually we made it to a trailhead and the cypress forest that quietly whispered with the ocean breeze. Emerging from the darkness of the overgrowth onto the expansive moonlit beach made it seem—at least to our adjusted eyes—as if it were light as day. We made our way across the flat landscape, meandering around countless tide pools whose glass top surfaces gave the impression that each was but a hole through the powder-soft sand, revealing the rest of the star-filled universe that continued past the horizon and wrapped under our feet. It was one of the calmest experiences in my life. No one spoke. There was motion, and sound, but everything was muted to the utmost extreme – Nature pianissississimo. Even the tide, with a hinting shimmer, partook in the symphonic movement nature was performing, lulling from a distance.

Eventually, at the horizon, something disturbed the celestial landscape. An abstract checkerboard surfaced through the sea and sand. For all our deprived senses could tell—and in the moment, prolonged by wonder, reason was suspended—it could have been a geometrically perfect mountain range, miles in the distance. But our feet then met its base, imparted scale, and reason returned. It was a tidal embankment; its perfect checkerboard pattern engineered to diffuse the forces of the water, and time, and safeguard the land entrenched behind it from joining the adjacent sandy, and subsequent watery expanse. A mountain range it was not, but from where we stood before it, along with the ocean and the lunar sand the structure completed the triptych background on which we would paint our light.

Barefoot, I moved towards the water to frame up the first shot, gliding like a steadicam operator across the hard packed sand, into the penny-depth waves that stretched out across the gentle incline, and deeper into the gentle surf with my eyes straining through the darkness to gauge the Rothko-esque composition of black that shifted before me. The water was warm, just the right temperature that if not for its resistance, it would be indistinguishable from the air, even though it was now up to my calves. Aside from the stingrays, for which I dragged my feet just slightly as a warning of my presence, the ocean floor here could be trusted. The long shore, fine sand, constant surf, and complete lack of foundational structures yielded a welcoming seabed devoid of even the tiniest rocks and shells. That was until my right foot, as it crossed in front of my left to keep me perpendicular to the embankment, caught something big and solid. Reflexively my foot instantaneously rose substantially before advancing to recover stride, but was again met with the same something. My momentum still carrying me, I turned to fall over whatever the mass was, and into the calm sea. Wide-eyed, and raising the tripod and camera to safety in one hand, I reached out with the other into the black of night to brace.

My hand met the surface, splashing seawater out in every direction. In the pitch black night my mind was relying on, and expecting solely a tactile sensation—no visual—so when my hand plunging into the water was also accompanied by an inexplicable flash of brilliant light and color, as millions of specks of lights swirled in inordinately complex eddies in the water as it enveloped my hand…

Pure wonder.

I had witnessed it all in perfect clarity as, by the time my hands had reached the ocean floor and I had stabilized somewhat, my face was but inches from the water's surface. My body relaxed. I eased slowly down onto the inanimate mass beneath me, rather than attempting to clear it. Whatever had caused my fall did not matter for the moment. Instead my mind was fixated on the supernatural spectacle before my eyes. The resultant blooms of light persisted past the initial explosive impact, fading slightly, but continuing to glow as they swirled around my now partly submerged body. Below the surface, the myriad of complex eddies continued to swirl with enthralling intricacy. The three-dimensional visualization of fluid dynamics persisted for another moment before fading completely, leaving me again in darkness, wide-eyed and alone; deprived of perception but for the tactile sensation of seawater that now enveloped my body and dripped from my face.

What... in all existence... had I just seen?

My mind, like my eyes, was wide open. 404 not found. No match. Extend search parameters. If only for a moment, aliens, fairies, and radioactive waste were all considered as completely legitimate explanations. I was a child again; the world was full of untold wonders, and dangers.

Enter reason. Were it not for the detail I had observed, I might have assumed the jarring motions of the fall had caused me to see the colors—aberrant

signals from an abused visual cortex—but the sight had been all too real; too laden with infinite complexity and detail of the real world to exist only in my mind. My eyes—still wide in their striving for input and unsure of their own reliability—blinked, and then darted around to capture the phenomena again. There was nothing, just the enveloping blackness of my sensory-deprivation-tank-like surroundings. Facing away from the shore, and towards the water, my vision failed even to confirm that I was indeed moving me eyes at all. I wanted to turn my head, towards the dimly backlit shore that lay on the horizon behind me. I dared not move, as if not to frighten the phenomenon from showing itself again.

After a few minutes of staring into the void of the night something did appear. At first there were dark undulating masses, and then faint colors. My eyes were playing tricks, fatigued and striving to find patterns or movement in the ganzfeld.[16]

Feeling defeated, and now a bit impatient I impulsively slapped at the water. It was more so to get my visual bearings, but also to break the moments of sensory deprivation. I was not expecting the luminous bloom to return; yet it did.

Same as before, the water around my hand erupted with millions of inexplicable specs of light that swirled around like two galaxies colliding under the water's surface.

The phenomenon had happened again.

It could be repeated.

It could be verified.

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[16] Wolfgang Metzger, "Optische Untersuchungen am Ganzfeld." Psychologische Forschung 13 (1930): 6-29.

I have included this lengthy, very personal anecdote about the evening I first encountered biolumenescent dinoflagellates, or glow algae, because it outlines what I consider a complete and authentic experience; the kind of experience many new display technologies often insinuate they are capable of providing. However, they all fall short. Their images persist between frames, but do not persist once the viewer looks away, or looks closer, or never looks in the first place. Part of what authenticates reality is its indifference. Unlike video media, born of event, spectacle, and attraction, reality does not perform for anyone, it simply is. [17] Things happen whether people are around to see them or not, and most of the time nothing happens. Life can be still, and boring. If the virtual is to truly compete with reality, it must reach the same benchmarks, not just for resolution, color, brightness, and frame rate, but also for darkness, stillness, and absence. It must have peace, and wholeness.

[17] Tom Gunning. "The Cinema of Attraction[s]: Early Film, Its Spectator and the Avant-Garde." In *The Cinema of Attractions Reloaded*, edited by Wanda Strauven, (Amsterdam University Press, 2006). 381-88.

Good Enough

Through the use of semiotic proxies—symbols and language—we have been able to articulate our minds more quickly, and generate models of the physical world around us more accurately. The resultant daydream-like realm of models and information is seemingly limitless because it lacks a physical presence. The varied processes of indexing and encoding physical things into digital signal deconstruct any materiality or dimensionality of the source input in order to produce signals, which can then be processed digitally. Subsequently, we are then reliant on devices to transduce the information from inaccessible, coded immateriality back into physicality—or at least visu-ality—so that it can be sensed and processed by our brains. Current visualization technologies have difficulty extrapolating digital information into something more tangible, through 3D conversion or virtual reality, because the information necessary to support the dimensional expansion was discarded during the process of encoding. In short, something is lost in translation. If information from the digital realm could take on spatial or material qualities in the process of transduction, it could convey additional information via its newfound multimodality, or if nothing else feel more natural.

Many virtuality-creating technologies have come along since John Arrowswmith's diorama (1824), [18] including Joseph Plateau's phénakisticope (1832), Muybridge's Zoogyroscope or "Zoopraxinoscope," [19] and Thomas Edison's kinetophonograph. The Occulus Rift, or any other contemporary virtual reality headset, is no different, in that it is

[18] Derek Wood. "The Diorama in Great Britain in the 1820s". History of Photography, Vol 17, No.3. (1993). p. 284-295 Web. 21 Aug. 2016. http://www.midley.co.uk/

[19] Stephen Herbert. "Who Painted the Discs?" COMPLEAT EADWEARD MUYBRIDGE. (January 28, 2009). Accessed February 07, 2017. http://www.stephenherbert.co.uk/muy blog3.htm#part15.

also "intended by its technicians and perceived by its publicists as one more step towards the *Recreation of Reality*, towards the realization of a perfect illusion of the perceptual world." [20] How many steps will it take to achieve a fully successful *Recreation of Reality*? Technology will always continue to advance, but can we ever expect to one day achieve inscrutable synthesis across all modalities? No. The approach is asymptotic. There will always be more to simulate, more accuracy to be had. That which is virtual will always be synthetic and unnatural. The question then becomes to what degree of scrutiny must a simulation hold up to in order to qualify as real enough? This question, which opens a subjective debate about what level of virtual fidelity would suit all disparate needs, also begs another more easily answered question: real enough for what? It is here that a stance can be taken on the definition of a base reality. For the purposes of this thesis and most matters of integrated media design, reality will be defined in a phenomenological sense as that which is experienced by natural human perception, which of course has its own inherent limitations, formed over time by evolution. [21]

For instance, the amount of visual detail we can discern via our eyes is finite, limited by our physiology. [22] These physiological limitations define a naturally occurring maximum sensorial bandwidth, and anything exceeding this threshold becomes real enough. Channels of synthetic information transduction—such as displays—need only to meet these thresholds to be capable of re-creating that which is convincingly real.

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[20] Noël Burch and Ben Brewster, *Life to Those Shadows* (Berkeley: University of California Press, 1990), 6.

[21] Maurice Merleau-Ponty, "An Unpublished Text," in *The Primacy of Perception, and Other Essays on Phenomenological Psychology, the Philosophy of Art, History, and Politics* (Evanston, IL: Northwestern University Press, 1964).

[22] Steven Yantis, *Visual Perception: Essential Readings, (Philadelphia, PA: Psychology Press, 2001).*

One such perceptual threshold has already been defined, technologically satisfied, and even commercially branded: "retina" quality screens are, by definition, of a resolution high enough so that the individual pixels that compose the screen are indiscernible by the naked eye at a distance of standard use (13 to 15 inches). Physically and technologically, it is possible to produce screens higher than this resolution density, but practically and perceptually, a higher resolution is simply unnecessary. [23]

Similar benchmark standards exist for other optical qualities, and most likely for each of the more than 21 other human senses. [24] Most contemporary displays are designed to exceed Pointer's Gamut—a standard that includes all naturally occurring color ranges—but display manufacturing companies are in a constant arms race to increase the contrast ratios of their screens and have yet to adopt a minimum perceptual standard. [25]

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[23] Hyun Lee, Et al. *Optogenetic Control of Body Movements via Flexible Vertical Light-Emitting Diodes on Brain Surface*. Vol. 44, (2017).

[24] Lorin Roche. "Come to Your Senses." Meditation 24-7. Accessed February 24, 2018. http://www.meditation24-7.com/page18/page18.html.

[25] Jeff Yurek. "How Much Color Gamut Do Displays Really Need? Part 2: How We Perceive Color." *Dot-color*. (July 16, 2014). https://dot-color.com/2013/07/16/how-much-color-gamut-do-displays-really-need-part-2-how-we-perceive-color/.

The Ideal Screen: A Registration Plane

In the process of capturing frames of video, and recreating the image elsewhere, the capture plane—the surface of individual film cells, or the sensor array in a digital camera—becomes analogous to the display plane. In theory, one can imagine the two surfaces as one: on one side the viewer, and on the other side the captured scene. However, in the traditional understanding of video, the viewer is meant to understand the display plane not as a surface, but as a virtual window through which the captured world (synthetic, genuine, or a hybrid of the two) can be viewed. The vast majority of video content produced since the invention of film has relied on this pretense, and its continued commercial success has only perpetuated and further ingrained the pretense as the industry standard for displaying content.

The problem is that any two-dimensional display fails to support a change in perspective. If the screen in a movie theater were to actually perform as a window—even a virtual one—audience members on one side of the theater would see a slightly different image of the world beyond, according to their individual perspectives, but two-dimensional displays show the same image from all perspectives. A change in the perspective of the viewer reveals the form of the screen, not the form of the objects displayed within it.

Perspectival issues can be sidestepped by reconsidering the assumption that a display should be treated as a window, which it is not, virtually or otherwise. Instead, it can be treated as a surface, which it is, literally. However, treating the surface of the screen as such makes for a vastly different kind of content, but one that more accurately reflects the nature of the medium, shadows, indexes that are true to the superficial nature of the screen.

At this point it is important to understand the distinction between transparency and translucency. Essentially, transparency refers to a material's ability to allow light rays to pass from one side to the other *without changing their course*. Think of a pane of glass. The crystalline molecular structure and planar macroscopic structure of glass allow light to pass through the material with almost no observable distortion, preserving the appearance of objects behind the glass. The ability to transport light without distorting appearance is at the etymological roots of the word transparent, which stems from the Latin stems *trans* which means 'through' and *perere* which means "appear".

Translucency on the other hand refers to a material's ability to allow light rays to pass from one side to the other, regardless of how scattered the original light may be. Think of a lampshade. A translucent material will transport light from one side to another, but may not preserve the image beyond. A material can be extremely translucent, but fail to transport an image, blocking optical clarity through itself. Still, in this case the light able to pass through the membrane would indicate objects beyond the surface without any optical continuity.

An ideal screen is one that is completely translucent, but also completely opaque. It destroys all extraneous information about the captured world behind it, including all light vectors, effectively destroying any image beyond the surface itself. However, this ideal screen also transports 100% of the light that falls upon it, but the light now emanates from the surface of the material itself, rather than from the scene beyond, as is the case with a display for which there is no scene beyond. To capture images that can be truly recreated by typical display technology a shadow-like index of a scene should be flattened by an ideal screen, or what I call a registration plane, *before* being recorded onto a capture plane.

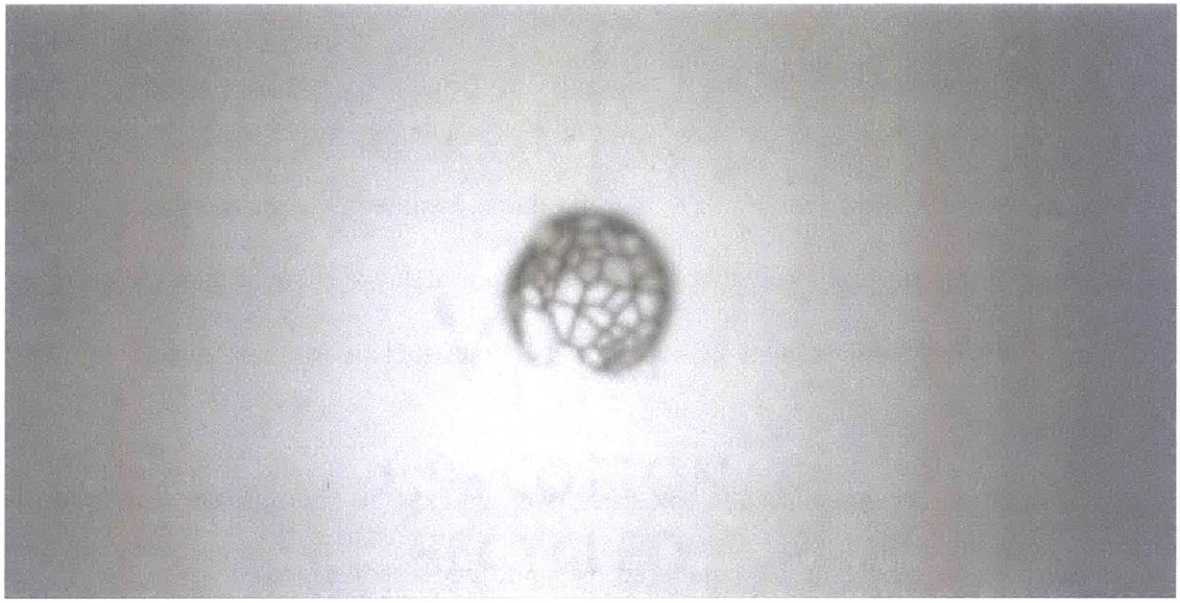

Figure 8.

Registration Plane I (iter. 1, Orb)
2015
Joshuah Jest
Projection installation

The installation *Registration Plane I (iter. 1, Orb)* consists of a projector displaying a video taken of trace paper backlit by the same projector. In the recorded image, an arbitrary object (in this case a 3D-printed orb) was dangled between the backlighting projector and the trace paper. When the video was played back, the appearance on the trace paper used for playback is nearly identical to the appearance on the original trace paper. The recreation of the shadow, and light source caused viewers to expect, and look for the original object, which is no longer physically present but now implied.

Individualizing Media: Maximizing Mediation

Today, the problems of discontinuity of media are exacerbated by the ubiquity of mobile devices. Now that we have high production value content available at any moment, it has become far less likely that we will choose to delay viewing content in order to share the experience with another person. For example, look what happened to the American living room.

Upon its invention the television was quickly adopted as the centerpiece in the American hearth. Families gathered around the technological marvel as it provided information, entertainment, and novelty of guaranteed and immediate social relevancy. The reach of the technology combined with the limited amount of content ensured that anything aired on early television would be of immediate importance to millions of others. People watched because *everyone* watched [Figure 9]; A phenomenon now known as perceived co-attendance. [27] Eventually however, the supply of content increased, and the cost of televisions decreased. A few decades later the average American home had more than one television, each with hundreds of channels, and the living room television went the way of the dining table—an essential fixture in every home, with a whole room dedicated to it, but less and less frequently used by more than one person at a time. The ritual of experiencing television *together* largely dissipated, as was the comradery that came with it. It was replaced with a far more dissociated form of co-attendance subject to the discontinuities of media.

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[27] Garriy Shteynberg, and Evan P. Apfelbaum. "The Power of Shared Experience: Simultaneous Observation With Similar Others Facilitates Social Learning." *Social Psychological and Personality Science* 4, no. 6 (2013): 738-44. Accessed April 9, 2018. doi:10.1177/1948550613479807.

Figure 9.

Watering Hole I (iter. 1, Pooling)
2017
Joshuah Jest
Projection-augmented sculpture

The second sculpture in the *Field Studies* series critiques how willingly families, and society entrusts youth to the unknown depths of digital media, wherein attentive parental guidance is replaced by unchecked and exploitative practices of implied co-attendance.

Unlike televisions, computers and mobile devices are inherently isolating. PCs are after all *personal*. They are almost exclusively designed for a single user; to be operated with one or two hands, and viewed within arm's reach. These limitations do not encourage shared use, in fact it is reasonable to go so far as to say that they discourage it. Physically sharing a mobile device is also inconvenient. Beyond occasionally half-offering a device to be viewed—not taken—by a friend, it is far more common to share content electronically. Sharing in this way allows the recipient to engage in the same pre-packaged experience on his or her own personal device, on his or her own time. However, while digital "sharing"

affords individuals the capability to view the same content anytime and anywhere, it assuredly means not now, not here. Whereas sharing something in person affords the ability to gauge the body language and other reactions of a co-attender in real time, and in real space; sharing something online often affords no such immediate, or qualitative feedback.

What sharing online *does* allow for is additional mediation. In today's Internet society, we glean co-attendance from the data and metrics supplied to us, rather than by direct observation of others. We must rely on "like," "view," "repost," or "up vote" counts in order to judge how much content has been co-attended. The problem is that these metrics are defined and provided by third parties. While these metrics appear to be objective quantitative data, their definitions are in actuality subject to bias, and fail to capture more qualitative, socially valuable information that occurs in real-time real-space co-attendance. Instead of relaying more socially valuable information, or even allowing users to "down vote" undesirable content, these metrics leverage minimal attention or action to imply greater engagement to help platforms influence *consensus reality* in service of the private interests. [28] These mechanics count a few seconds as a "view," the tap of a finger as a "like," creating an ill-defined range of interaction that can be manipulated to serve an agenda or for profit. [29] By lowering the bar for what would normally qualify as co-attendance, platforms can increase attendance of anything they choose.

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[28] Lily Splane. *Quantum Consciousness: A Philosophy of the Selfs Potential through Quantum Cosmology*. San Diego, CA.: Anaphase II Publishing, (2004).

[29] The number of times [a] video was watched for an aggregate of at least 3 seconds, or for nearly its total length, whichever happened first. "3-Second Video Views." Help Center. Accessed January 17, 2018. https://www.facebook.com/business/help/743427195703387.

Outside of the construct of social media platforms, one would pay little attention to everything one's friend might "like" while browsing a given information feed. "Like"s are cheap and are given away too freely for us to care about them individually. However, that one "like" of a friend (someone you have designated as a known and marginally trusted entity) can be selectively recalled to establish personalized credibility to a larger aggregate of anonymous likes. A platform can then use the combined qualitative credibility of a known entity and the quantitative number of anonymous likes to imply greater co-attendance and thus greater importance of the content of its choosing. This process strips the act of viewing of its nuance, including judgment, before it is disseminated as a metric to a global audience. There is no opportunity for group evaluation, other than toxically linear comment threads, and limited expression buttons. [30] This absence of input from a social circle during the moment where opinions are being formed is damaging, as it privileges the judgments of biased opinion surrogates such as hosts, moderators, reporters, commentators, and various on-screen personalities over the judgments of friends, family, and neighbors.

This is all to say that the technologies that promise connection are more often promoting a state of general disconnection. In this state of disconnection technologies and mediating entities (social media platforms, translators, new outlets, etc.) have the power of brokering connections of their choosing. To counteract this practice of leveraging disconnection, which relies on isolating users, we need technologies that physically bring people together.

[30] Linear comment threads such as live comments act against sustained conversation as all additional comments are listed sequentially, and not in reference to each other. Out of context, comments and the conversation they sustain end up meaning less.

Figure 10.

Center Pivot I (iter. 3, Share Cropping)
2017
Joshuah Jest
Projection-augmented sculpture

The first sculpture in the *Field Studies* series critiques the media infrastructure designed to cultivate opinions. Devices and social media platforms are designed to propagate information almost autonomously. This vignette depicts media devices being cultivated, autonomously spreading trends (colors) before even entering the hands of a users.

A Materialist Approach

In order to alleviate the aforementioned individual and societal symptoms of rapid expansion of media technology, we must find a way to reconcile the draw of metaphysical freedom of the virtual with the weight and consequence of reality. The virtual will continue to exist independently of physical reality, but some of what it has to offer, especially in the way of experience would benefit from being more grounded in the material world. Such a union of the virtual and the physical would require a significant increase in the coordination between the two worlds, such as the mapping aspect of projection mapping, and computer vision that has recently been implemented to support augmented reality platforms. Yet independently of the underlying media technology the content itself must also more closely adhere to reality if it is to gain some of the perceived matter and weight of the material world. The mindset of creating life-like content has been around for some time, dating back to classical paintings, and has resurfaced occasionally in different ways. During Disney's renaissance in animated films the approach crystalized in the form of the Twelve Principles of Animation, a list of rules put forth by Disney's lead animators Ollie Johnson and Frank Thomas. The rules, which outlined material traits that should carry over into animation, included squash and stretch, anticipation, staging, straight ahead action and pose to pose, follow through and overlapping action, slow in and slow out, arc, secondary action, timing, and solid drawing (which related to the dimensionality of animated objects). [31] Though these principles were set forth to inform the process of animation, the idea

[31] Ollie Johnston, and Frank Thomas. *The Illusion of Life: Disney Animation.* (New York: Disney Editions, 1981).

extends to the creation of any virtual content with the intention of conforming to reality in order to appear more real.

As the larger underlying principle of such efforts is to make virtual content adhere to the material properties and limitations of the physical world, I have elected to refer to this general design strategy as the materialist approach. Though tangentially related to the contemporary media theory concepts of media materialism, and new materialism, in which media of all kinds are considered as part of a total and global material exchange, the approach of which I speak is more directly related to philosophical materialism, which observes physical matter—as opposed to perception or consciousness—as the basis of reality and truth. [32] Such a materialist approach to the design of virtual content would be more mindful of, and purposeful with departures of the virtual from physical reality. By default, content resultant from the materialist approach, or *materialist content*, would depict things, such as humans, at their actual scale. Even this simple principle of preserving scale requires a massive shift in the paradigm of universally compatible media. No longer will it be so simple to display the same video across billions of TV screens, websites, and marquees. Instead a separate video will need to be produced for each differently sized screen. It will become harder for corporate conglomerates to copy and paste content into digital displays. Content that does not honor materiality will appear foreign. Content will become more tethered to objects, and hopefully also to place. It will gain some of the locality of architecture.

[32] Jussi Parikka. "A Geology Of Media And A New Materialism." *Digital Culture & Society* 1, no. 1 (2015). doi:10.14361/dcs-2015-0113.

Integrated Media

Materialist media requires, to some degree, that media technologies also be better integrated into the built environment. It is a challenge that is best met from both sides; with content being designed for specific objects, and objects being designed for specific content. The term *integrated media* comes to mind. Currently the term is also used to describe cross-platform media coordination, such as advertising campaigns that coordinate across internet, television, and print media. However, the term is too apt to pass over. Integrated media in this context would entail purpose-built, site-specific displays and interactive media that are consciously integrated into society as they are into the built environment. Traditionally, what discipline is charged with designing and constructing the built environment to best suit the many competing factors of society?

Media Architecture

Architects, who once defined their practice as the design of the built environment to best facilitate humanity in all its endeavors, stand to lose claim to the foundation of human experience, as the experience of physical space is increasingly supplanted by the experience of the virtual. The domain of our primary experience is now a composite. The virtual territory is piecemealed together by computer scientists, programmers, cinematographers, writers, game designers, user interface and user experience designers with no semblance of master planning outside of an underlying network protocol and device-determined visual presentation norms. The result is a world of infinite connection and possibility, but also one of infinite fracture, leading to increasingly balkanized social and psychological landscapes. Why should the virtual not fall under the purview of

Architects, of those trained most adequately to orchestrate elements of such spatial, psychological, social, and philosophical nuance into the total environment?

Architects are trained to organize teams and to synthesize solutions that satisfy criteria across multiple fields. Integrating media into the process would only require more groups into the planning process. Trends and best practices will emerge, but only once data-analysts are being asked what kind of a *space* their data needs to be more easily understood by the public, and are being asked in the presence of programmers and UX/UI designers capable of producing a tailor fit solution.

This is not to say that architects should become the new gatekeepers of information, only that they should play a more active, leading role in facilitating the creation and integration of new tools for public and private knowledge production and information dissemination. Such a transformation would amount both to a more formal association with the field of computer science—particularly data and systems architecture—akin to Architecture's current relationship with Engineering and material science, and to a proportionate investment in communication theory akin to Architecture's current investment in arts and aesthetic theory. Reciprocally, static architecture, or any physical form for that matter, stands to gain "ephemerality and consilience that architecture has long resisted," and in doing so, to correct what Sylvia Lavin identifies as architecture's original and most critical sin: "that it could not tell stories in the manner of poetry and painting." [33]

The notion of a brick-and-mortar media architecture, composed of displays physically embedded in the environment may be a fool's errand. Augmented reality

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[33] Sylvia Lavin, *Kissing Architecture*. (Princeton, NJ: Princeton University Press, 2011). 5, 10, 22.

technologies already enable us to experience a sensory landscape where the natural and physical are mixed with the synthesized and the immaterial, and the fidelity of the virtual images they impose will only increase with time. Some day soon, it will be possible for multiple individuals to experience the same augmented environments. However, the ability to share this experience will require the supporting technology, excluding those who cannot pay for or are otherwise unable to use that technology. Furthermore, the composite nature of augmented reality makes it easy for a shared reality to be broken down into more granular elements of experience, which may not be shared. For example, in the near future it will likely be possible to "skin" one's environment as easily as applying a SnapChat filter. One person may choose to recolor the world in shades of pink, while another person may choose to make everything dark with Tron-like light accents. The two individuals would experience *some* of the same reality, but not *all*. The same inconsistency could apply to any number of other factors we use to define reality. This fracturing of reality represents an unparalleled opportunity for propaganda, even by today's standards, and threatens the elimination of a shared experience—a complete fracturing of the commons.

Materialist and integrated media, and media architecture can protect against this threat, as they minimize mediation and are tethered to the material domain, which cannot be so easily disrupted.

Figure 11.

Star Dome
2015 - Ongoing
Joshuah Jest
Permanent Projection Mapping Retrofit for the Houston Astrodome

The Star Dome is an exemplary project of materialist media, integrated media, and media architecture. The project is a proposal for a permanent site-specific projection installation for the Houston Astrodome. The project is akin to Stan Vanderbeek's *Movie-Drome*, another large projection dome, designed to fight back against the early individualizing effects of computers and telecommunications.[34]

The installation design capitalizes on a number of the Astrodome's many unique architectural features to create a multimedia experience that will be, and will remain unlike

[34] Sutton, Gloria. *The Experience Machine: Stan VanderBeek's Movie-Drome and Expanded Cinema*. (Cambridge, MA: MIT Press, 2015). 11.

any other in the world. The design utilizes a multi-projector system inside the stadium to create a single ultra high-resolution concave display on the interior of the domed roof. Because the translucent skylights allow video content to appear on both the interior and exterior of the building, the installation can act both internally as the world's largest media-augmented environment, and externally as a city-scale media facade. This dual functionality allows the installation to support a wider variety of monetizable and public uses than any other media installation in existence, adding immensely to uniqueness, versatility, and multi-purpose capabilities of the reimagined Astrodome venue. The installation would transform the entire building into a media spectacle, as it once was, but one more capable of showcasing a greater variety of contemporary artistic, entertainment, advertising, and interactive content.

Deeply integrating the media installation with the architecture of the building helps to create, and become part of a new post-reopening identity of the Astrodome. Rather than simply restoring the Astrodome, a considerable feat of its own, the Star Dome proposal seeks to go further—to reanimate not just the public image of the "Dome", but the original uncompromisingly innovative spirit from which it was born, and in doing so modernize the Houston icon to more adequately reflect the identity of the Energy Capital. In order to fully realize this vision, the installation's needs must be adequately prioritized in the design and engineering of any and all renovation efforts at the Astrodome. Embracing the integration of the installation early on in the renovations of the Dome will ensure that the installation—which is intended to revive and redefine the vary landmark that defines the city of Houston—is realized at the utmost excellence.

Star Dome Installation Summary

The Star Dome installation consists of thirty-six (36) projection points specifically arranged in a symmetrical manner to facilitate uniform coverage of the domed roof interior, and minimize shadowing resulting from indirect angles of projection.

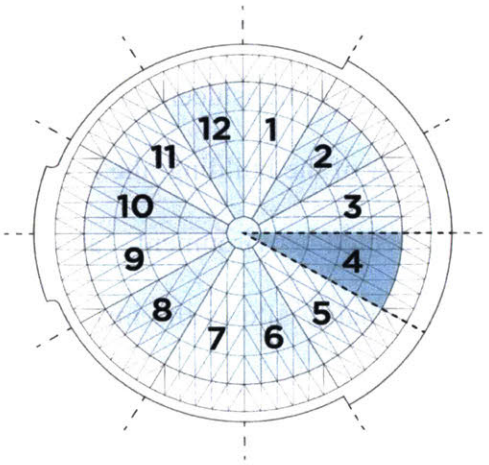

Figure 12.

Projection points are situated in relation to the roof's lamella trussing, yielding twelve (12) identical sectors radially symmetrical around the center of the floor [Figure 12]. Each sector has three (3) corresponding points of projection. One of these points of projection covers the smaller central end of the sector [Figure 13, Zone 1], leaving the remaining two points to share coverage of the larger outer portion of the sector [Figure 13, Zone 2 & 3]. All projection areas overlap slightly to ensure no gaps in projection coverage between projection areas or between sectors.

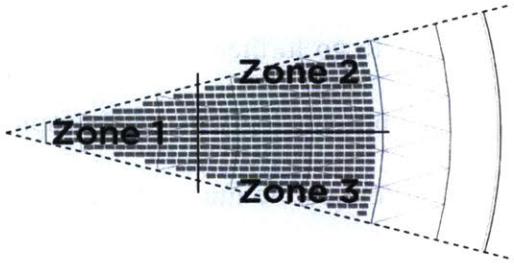

Figure 13.

Combining all twelve (12) sectors results in points of projection organized into two (2) concentric rings; The central ring with twelve (12) points of projection, and the outer ring with twenty-four (24) points of projection. It is possible, but less ideal to combine the two outermost projection points in each sector to a central point between the two previous locations. This yields an outer ring with the same number of projection points (12) as the central ring - but causes steeper angles of projection, which significantly increases the optical interference and shadowing in the projection areas of the affected projection points.

In order to most economically achieve the desired brightness (Approximately 700 lux) with equipment available on the market as of 2017, each point of projection consists of three (3) thirty-thousand (30,000) lumen projectors, for a total of one-hundred and eight (108) projectors. These projectors are aimed at the same location, stacking their projection areas to increase the brightness of the area while maintaining a single image [Figure 14].

Figure 14.

Part III

The Screen Machine

The virtual is alien. As it colonizes our shared reality the virtual brings with it foreign priorities and biases. Behind each type of display there lies a body of power. For early movie theaters the body of power was comprised of moviemakers; those who were most familiar with movie-making technology were in the position of curating how the technology would be used. For early televisions the body of power was comprised of the first broadcasting stations, which had the capability to produce and distribute content to the new infrastructure of consumer electronics. Modern computers allow for significantly more agency, allowing users to engage with the content of their choosing, but there are still influencing bodies of power in this system as well. Most people need an operating system and browser in order to access the information available on the Internet and fully utilize a computer. These operating systems and browsers determine which sources of information and services are most readily available to users. Nested further within these operating systems and browsers, individual websites also influence what information is readily available, and thus what information is seen and subsequently shared.

The biases of various virtual platforms have been leveraged countless times, but one certain media deployment sticks out in establishing the current uses of screens on the global stage. As Fred Turner outlines is his book *The Democratic Surround: Multimedia & Amercian Liberalism from World War II to the Psychedelic Sixties*, in 1959 the Unites States State Department organized what has been called the "single most important

American exhibition of the Cold War." [35] Though sold to the American and Soviet public as a "cultural, scientific, and industrial exhibition," intended to promote "mutual understanding" between countries, the Unites States Intelligence Agency (USIA) had ulterior motives of *persuasion.* [36] Ultimately, their goal was to pitch the ideal life afforded by American capitalism, so as to drive the soviet population and economy towards consumerism and away from military spending. To do this, the USIA coordinated with Jack Masey, George Nelson, Buckminster Fuller, and Charles and Ray Eames to design the exhibition. Charles and Ray Eames created *Glimpses of Amercia the U.S.A.*, a multimedia installation that featured seven giant screens that simultaneously depicted footage from "average" American lives. The installation tapped into the visual aesthetics of the newest tube televisions at the time. Though the screens were projected, their shapes were slightly rounded to give the appearance of a modern tube display. The seven screens echoed the audio/visual storefronts in every American town that featured a wall of stacked televisions. The wall of screens represented surplus, bombardment, power, variety, infrastructure, entertainment, consumerism, and the early stages of mass media. The Eameses' installation transplanted all of this symbolism right into the heart of Moscow.

The installation did more than broadcast a potential lifestyle to the Soviets, it cemented the Cold War era one-way usage of television into the identity of the United States, and the identity of the screen. From this point forward it was clear that the screen could be used as a tool of manipulation, that its frontality could be weaponized. Combined with the aforementioned individualizing tendencies, the screen became an ideal tool for those seeking to divide and conquer.

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[35] Fred Turner, *The Democratic Surround: Multimedia & American Liberalism from World War II to the Psychedelic Sixties.* (Chicago, IL: The University of Chicago Press, 2013). 247.

[36] Ibid. 248.

D.I.Y. (Display it Yourself)

To counteract the bodies of power behind the screen, the screen itself must become subject to the will of the people. Displays must be dismantled, broken, distorted, and manipulated; they must be fully owned by the people. Displays should be seen as a malleable material to be utilized to facilitate specific messages, for specific times, for specific places, rather than a plug-and-play back box to import colonizing media. But you can't just cut a flat screen television in half. Taking control of the display requires an understanding of the underlying technology, some of the basics of which are touched on later in the next sections.

Control can be exercised at any number of points in a systems of display technology. Many individuals already create their own traditional content; filming, editing, and composing their own video, but there are also those who extend their control deeper into the guts of the video apparatus. Glitch artists and "datamoshers" reach inside of video encoding and decoding procedures to interfere with the translation of images. The same can be done outside the digital processes of display, by physically interfering with the image after it has been created. It can be rather difficult to manipulate standard rectangular displays, but there are other ways of creating custom forms from standard displays.

Modern displays such as computer monitors and flat screens create images on their surface. These images are part of the device itself, so in order to change the form of the display it is necessary to change the form of the device. Projectors on the other hand are particular conducive to alternate forms of display, as the image they create does not become part of the device. Projectors cast immaterial light fields that only become displays upon encountering matter. Projectors are inherently incomplete without a physical object to

bring their images into existence. Because of this, the projector aligns very well with the materialist approach and integrated media.

Contrast

Do you keep a white background on your computer? Work in a white workspace? Or maybe you have sought out darker interface "skins"? This likely comes from a subconscious desire to decrease the contrast between what is on your screen and your surroundings, which can reduce the stress on one's eyes.

Contrast ratio, a measurement that compares the luminance of the brightest and darkest values a given display can generate, may be the aspect of display technology that requires the most improvement to equate the natural environment. One would assume creating darkness is easy, as darkness is simply the absence light; however, creating true darkness can in actuality prove quite a challenge because of the way conventional display technologies operate. Almost all current display technologies, such as light emitting diode displays (LED), liquid crystal displays (LCD), and digital laser projectors (DLP), rely on manipulating a base source of light that remains entirely on during use, meaning that the area within a display always gives off some measure of luminance, even when displaying "nothing". Only displays utilizing organic light emitting diodes (OLED) currently offer the capability of representing blacks with a complete absence of light, as the brightness of each pixels is able to be controlled individually, allowing for unused pixels to simply remain off. Until recently, however, the commercial viability to OLED technology has been hindered by the imperfections and short shelf life or the "organic" components. As the technology is

perfected it is likely OLED technology will phase out other display technologies in most consumer electronics, particularly in virtual reality headsets where light leakage is most perceptible as the displays are mere inches away from the eyes of the viewer.

Furthermore, to match the sensation of the brightest naturally occurring objects, like the sun or even just a flame, a display would need to be capable of emitting a full spectrum of wavelengths that would go beyond visible light to include infrared and ultraviolet light. Even in terms of luminance alone, display capabilities are vastly limited simply by power consumption, and energy density, especially in a mobility-driven market. However, while current display technologies may be incapable of reaching the highest perceptual benchmarks, for the time being there are other benchmarks to adopt as temporary standards. The human eye's dynamic range—a receptive equivalent of a contrast ratio—is itself also limited, and also extremely relative. Because of the relative nature of the human eye's ability to sense brightness, the pragmatic benchmark of synthetic luminance can be assumed to be a level of brightness that does not exceed comfortable viewing—or is within a dynamic range between the darkest and lightest points in an environment. [37] A display, such as a projector, capable of synthesizing lighting conditions consistent with the environment would be capable of presenting a more perfect illusion. It is for this reason that projection and light-art festivals are typically held at night, in a setting that falls within the range of contrast that may be achieved by standard projectors. These festivals are microcosms in which we see some of the first examples of an environment matched in capability by an augmenting technology.

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[37] Steven Yantis. *Visual Perception: Essential Readings*. (Philadelphia, PA: Psychology Press, 2001).

Figure 15.

Promythic
2013 - Ongoing
Joshuah Jest
Electronic garment design and supporting technology

As part of an ongoing effort to "dermify", or externalize personal data that would typically only be available through computers, the Promythic jacket is designed as a tool for fashionably expressing personal data in the real world.

The jacket uses onboard light sensors to adjust its brightness to achieve the desired brightness relative to ambient light levels. Instead of turning on when it gets dark, the jacket's programming works to make sure the patterns of the light stripes are always detectable, but never overpowering.

Frame Rate

In taking finer control over the full faculties of video media, a display's temporal resolution must also be fully understood. The creation of moving images or "movies" was achieved through technologies that allowed for the rapid display of successive images. Early hand-cranked films displayed individual frames at a rate that varied wildly between 16 and 24 frames per second. [38] The variation was due to the fact that an operator provided the mechanical power, by *hand.* A rate of thirty frames per second has become the standard frame rate, as it exceeds the rate necessary to achieve the illusion of object continuity between successive images. [39] While this temporal resolution of thirty instances per second successfully hides the underlying serial nature of recreating motion with individual frames, establishing the composite images sequence as a dynamic gestalt, over the years this rate has proved to have upper limitations in the speed of motion it can precisely—and therefore convincingly—recreate. Recently the film and gaming industries—those most committed to precise *Recreation of the Real* as a means of creating more immersive experiences—have begun to adopt new standards of 60 and 120 frames per second. Up to four times that of the previous standard, the faster rates offer higher temporal resolution for visually transmitting digital information, allowing displays to depict smoother motion, and to more accurately depict objects moving at high speeds. Trumbull Studios of Famed movie-magician Doug Trumbull has developed an "advanced capture and display solution" that

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[38] Julie Brown, "Audio-visual Palimpsests: Resynchronizing Silent Films with 'Special' Music," in The Oxford Handbook of Film Music Studies, ed. David Neumeyer (Oxford University Press, 2014), 588.

[39] Burch, Noël, and Ben Brewster. *Life to Those Shadows.* (Berkeley: University of California Press, 1990).

presses the temporal envelope even further. [40] The Magi system supports 120 frames per second, but does so in stereoscopic 3D, meaning the actual frame rate is doubled for a total of 240 frames per second, and at 4k resolution. [41] These new standards promise lasting support for new displays that account for relative motion of the user, such as those in virtual reality visors. However, it has yet to be evaluated if the new rate can convincingly compensate for both a viewer's head movement and the depiction of high speed motion, or if a still higher frame rate will be needed.

As it stands frame rates are sufficient enough for most purposes, but it is also important to remember that the frame rate is variable. Though a display may be capable of 120 frames per second the rate of the video content may be lowered to create stop-motion[42] like effects that call for the user's attention the frame rate.

[40] Thomas Hauerslev. "Ladies and Gentlemen, This Is MAGI Cinema Find out about Douglas Trumbull's New Digital MAGI Cinema Process, and How It Might Change How You See Films in the Cinema." In70mm.com. Accessed July 16, 2018. http://www.in70mm.com/news/2016/magi/index.htm.

[41] Ibid.

[42] See Phil Lord, *The Lego Movie* (2014)

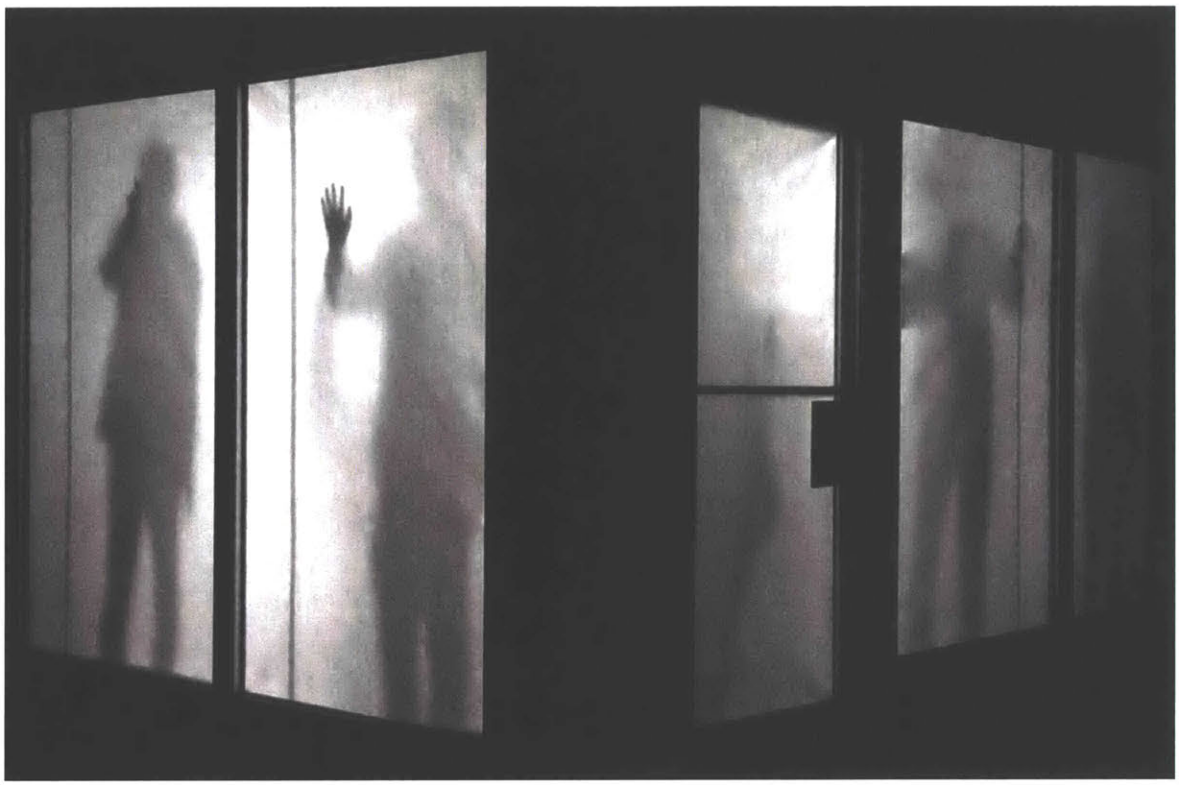

Figure 16.

Room I (iter. 4, Temporal Granulation)
2015
Joshuah Jest
Integrated media installation

Room 1, also known as *Test Room 1* is a continuation of the ideas explored in the *Registration Plane*, and *Box I*. The two-channel projection installation perfectly recreates the shadows cast by real people in the room. For the 4th iteration, *Temporal Granulation,* the video playback is then made to fail, disturbing the reality created by the illusion. Sometimes the video is cut, making it appear as though the solid figures teleport. Other times the frame rate is decreased, making the seemingly "real" figures quickly snap between positions as if animated by stop motion. The iteration was meant to point out how jarring temporal manipulations in film would be if interpreted more literally.

Resolution

In thinking about the visual representation of the virtual, it is hard not to address the pixel. Like the atom for matter, and the bit for the digital, the pixel is the smallest quanta of virtual display. Pixels are the texture that covers all things virtual. They are becoming smaller and smaller, and are now nearly imperceptible. The current standard of "retina" resolution, which satisfies the perceptual benchmark for resolution, was first achieved—at least commercially—by Apple. However, the computational power required for display-processing still limits this density to a small area of our visual field. A "retina" display on a mobile device can tout full high definition resolution (1920 x 1080 pixels), but only across a few inches, and less than 3% of a standard field of vision, which is has a resolution between 770,000 and 1,700,000 receptors. [43] Even much higher resolution—and significantly less mobile—displays such as 4k (UHD 3840 x 2860 pixels) and 8k (7680 x 4320 pixels), which push modern display-processing capability, are still only capable of covering less than a quarter of a standard field of vision with "retina" resolution.

There are some specifics of the human retina that could be exploited in order to reduce the necessary resolution required to meet the maximum perceptual bandwidth in terms of resolution, such as concentrating pixel density and color fidelity within the fovea. However, taking advantage of the fovea would require a display in fixed relation to the retina. Such solutions are not pragmatic without embedding the display within the eye itself—an endeavor that comes with its own numerous challenges, many of which fall outside my field of expertise. Venturing further into more anatomically-integrated

[43] Jonas, Jost B.; et al. "Human Optic Nerve Fiber Count and Optic Disc Size". *Investigative Ophthalmology & Visual Science* 33 (6), (May 1992).

solutions, the raw neural signals that makeup visual perception could themselves be manipulated at a number of intracranial points, most notably directly within the neural strata of the visual cortex. [44] Ocular and neural implants aside, it will still be at least another half decade until a single display can cover an entire visual field at retina resolution, and likely a decade until that technology is commercially available. At such a time it will become possible for a display to compete with the resolution at which humans perceive the world, possibly making the total illusion a reality.

For the time being, the illusion of the screen is constrained within a frame of the supporting device. With projection displays however, pixels can be themselves augmented. Rather than augmenting reality, one can think about augmenting the virtual with material. This becomes especially easy with a projected display as mentioned before.

For example, in *Digital Terrarium* [Figure 17], the projector projects pixels onto the texture of live moss. Each pixel is ripped apart as it falls on different fibers at various depths. As a result, the pixel appears to have dimension and complexity beyond that afforded by the original display technology.

[44] Yantis, Steven. *Visual Perception: Essential Readings*. (Philadelphia, PA: Psychology Press, 2001). 147-167

Figure 17.

Digital Terrarium
2018
Joshuah Jest
Digital animation projection on living sculpture

Digital Terrarium explores the synthesis of the virtual with living matter. Micro projection mapping is used to cast an ultra-dense resolution display onto tiny translucent plant matter for the finest degree of physio-virtual resolution.

Dimensionality

Adding dimension to screens and their content can counteract part of the individualizing effects of the screen. As mentioned before, small rectangular displays discourage shared use. The size and proportions of an onscreen image can become distorted when viewed from anywhere other than directly in front of the display. However, if a display bends into the third dimension it can be viewed from multiple angles. The matter of image distortion remains, but now the screen can support more viewers with a frontal—although partial—image. This in turn causes a new issue. A display that serves multiple perspectives may never be viewed in its entirety. A viewer may only see a portion of the full content. In this way the screen begins to behave more like real objects, which do not reveal themselves completely from one perspective. This is where the materialist approach and integrated media practices comes in. The materialist approach would yield form-specific content that would be designed to be seen only in part, and to avoid perspectival issues; while the practice integrated media would produce a content-specific, site-specific form that would frame the subject matter of the media content. More importantly, adding dimension to displays results in an increased capacity for simultaneous viewership.

There are a number of ways in which dimensionality can be brought to various displays, each method augmenting the content in different ways. Most simply displays can be juxtaposed into larger compositions. However, since the display is inherently rectilinear the forms that can be generated with the shape also tend to be orthogonal in nature [Figure 18], adhering to the shape grammar of the display. Displays can also be projected onto various forms, and in doing so adopt their features, and textures as seen in the projects listed hereafter.

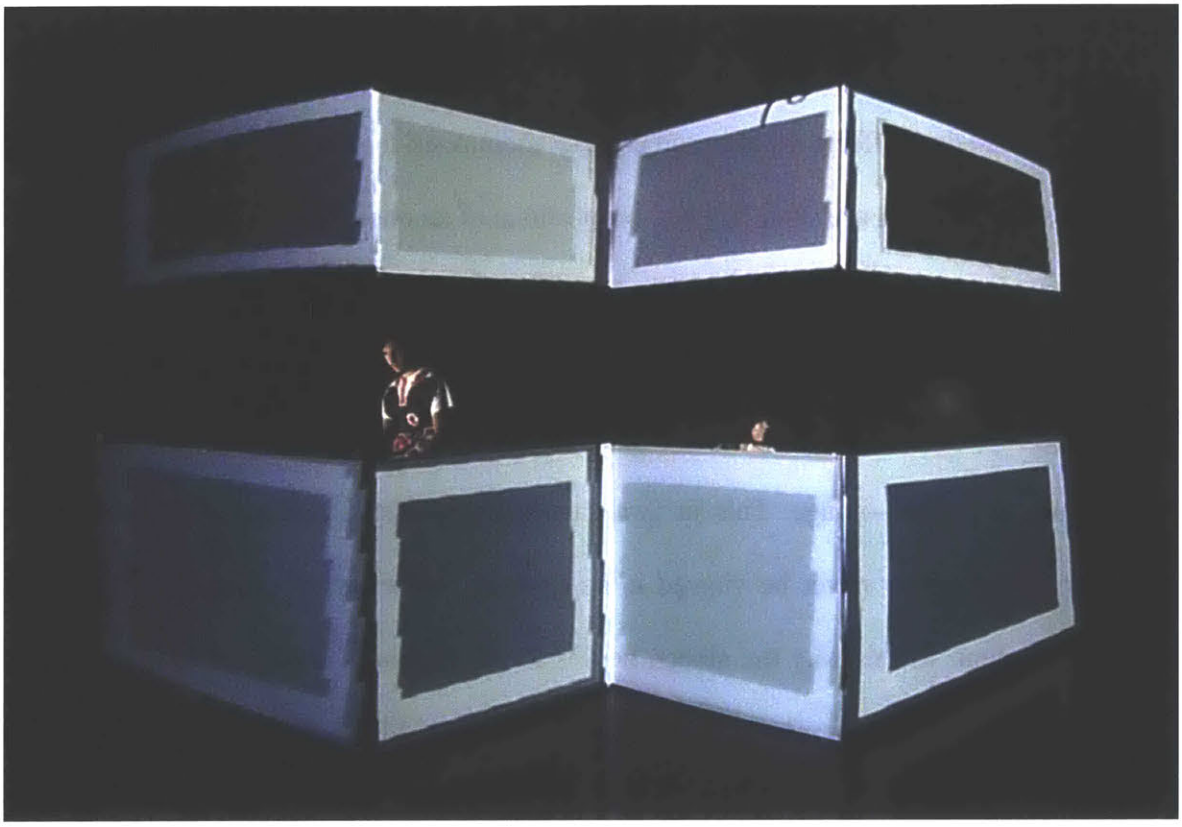

Figure 18.

NOT A RAVE
2012
Joshuah Jest
Generative digital video projected onto foam sheets

NOT A RAVE is a projection-augmented sculpture designed to explore how displaying multiple instances of a video effects the legibility of the content. Playing a video on the sculpture reads very different than playing a video by itself. The content becomes less of a focus and the directionality and movement within the frame becomes more noticeable.

Additionally, *NOT A RAVE* serves as a simple demonstration of one of the more basic ways to create three-dimensional forms out of square video displays.

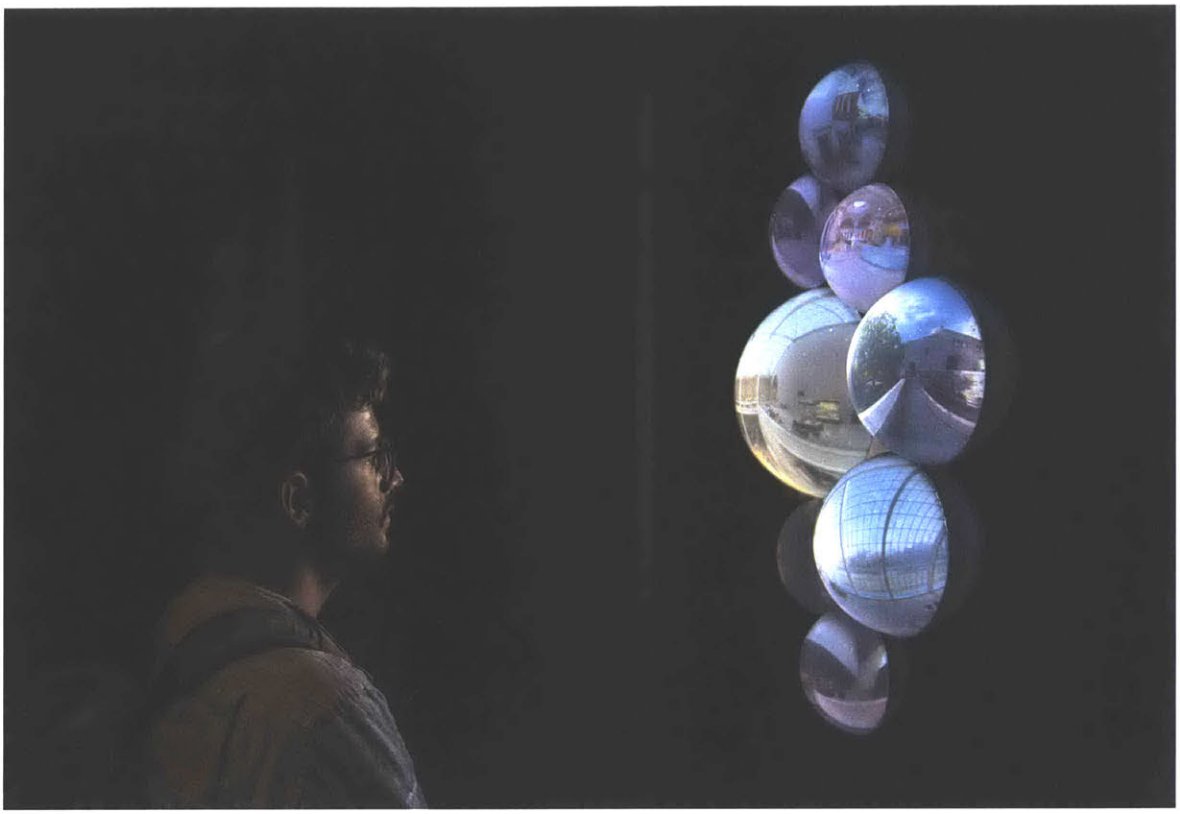

Figure 19.

Vantage Condensate
2018
Joshuah Jest
Digital video projection on acrylic spheres

Vantage Condensate is an alternative video form for 360 degree videos. The design is meant to display collections of vantage points, offering a view at the gestalt of a place, or a number of experiences formed by many different vantage points. *Vantage Condensate* also demonstrates that forms other than the flat rectangle may be more appropriate for certain video formats.

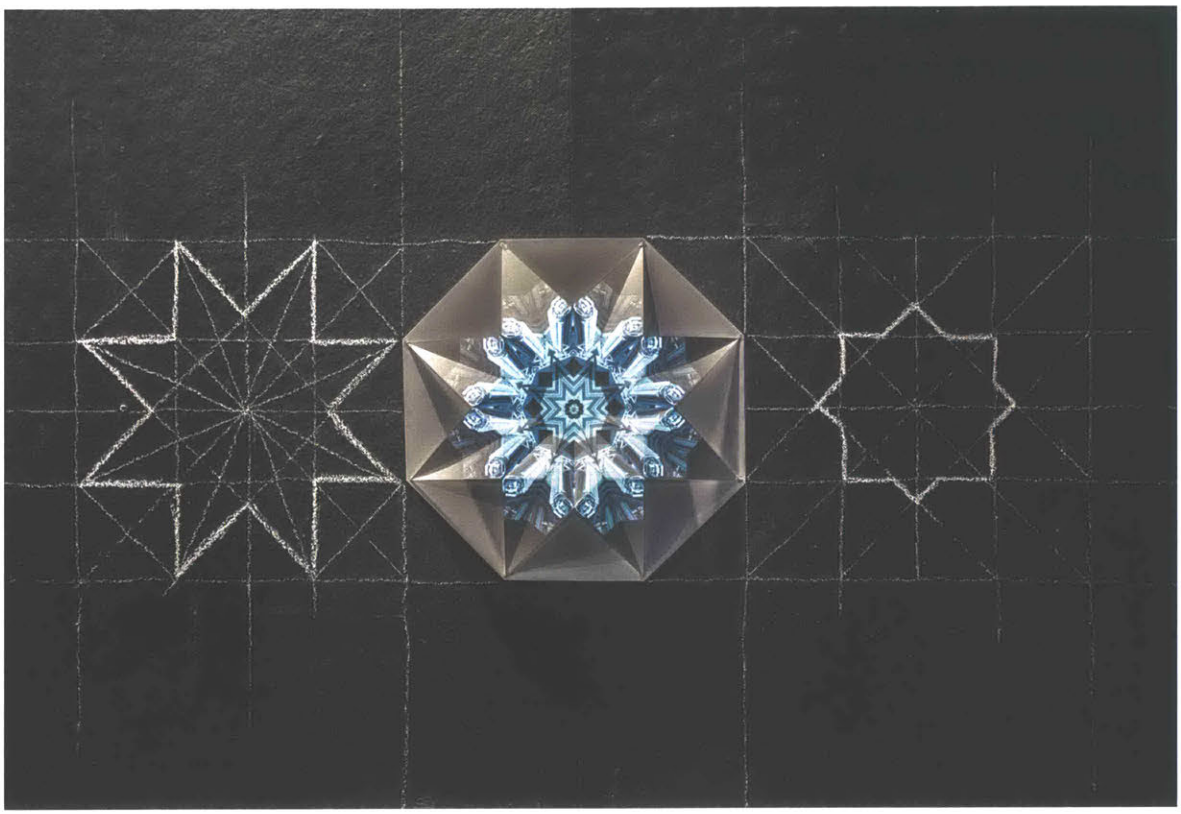

Figure 20.

Awescope
2018
Joshuah Jest
Generative digital video projected onto paper

The *Awescope* is a demonstration of how complex physical geometries can be matched with form-specific content. Simply put, the underlying paper is folded to produce the form, and the video receives corresponding manipulation to match. The result is a hyper-object in which the media moves freely within the physical facets of the form. The piece demonstrates that triangular fragments of videos can create more complex three dimensional forms than rectangles.

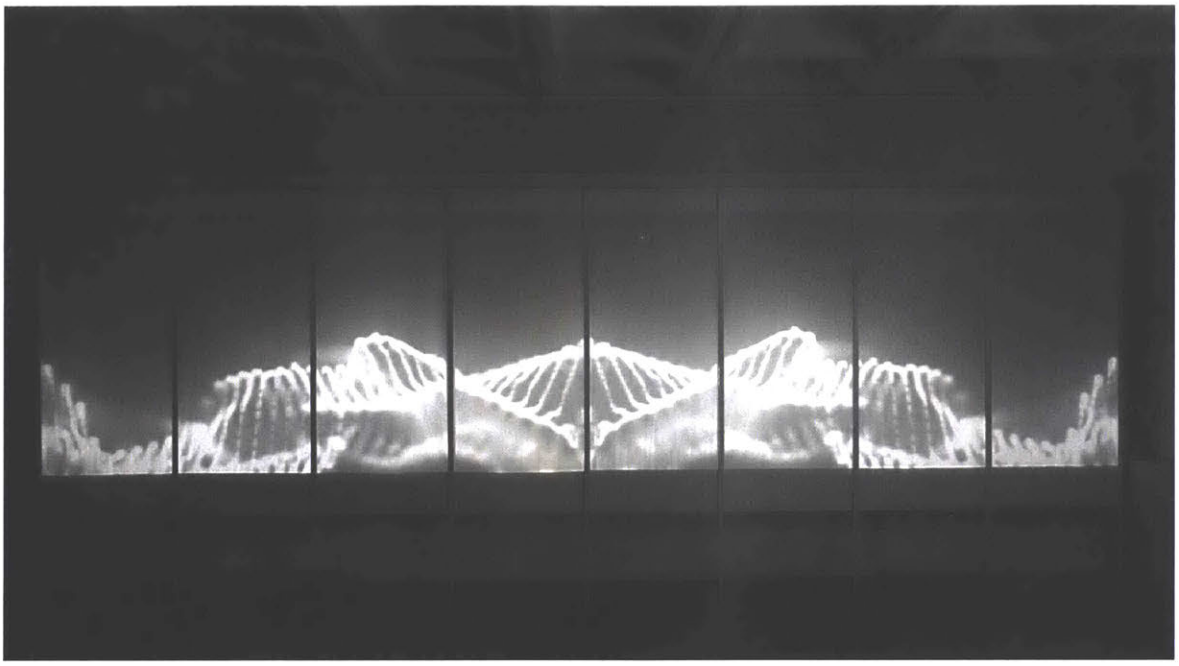

Figure 21.

Beyond the Surface
2016
Joshuah Jest
Generative digital video projected onto trace paper

This installation was designed to give depth to projected images, which are typically planer. The projected image falls upon trace paper. While the trace paper acts as a screen, capturing most of the projected light and producing a clear image, it is also transparent, and allows some of the light to pass onto the wall just a few inches beyond. The light that passes through becomes diffused, giving a soft glow behind the brighter images in the foreground. The result is an illusionistic suggestion of light emitting matter beyond the surface.

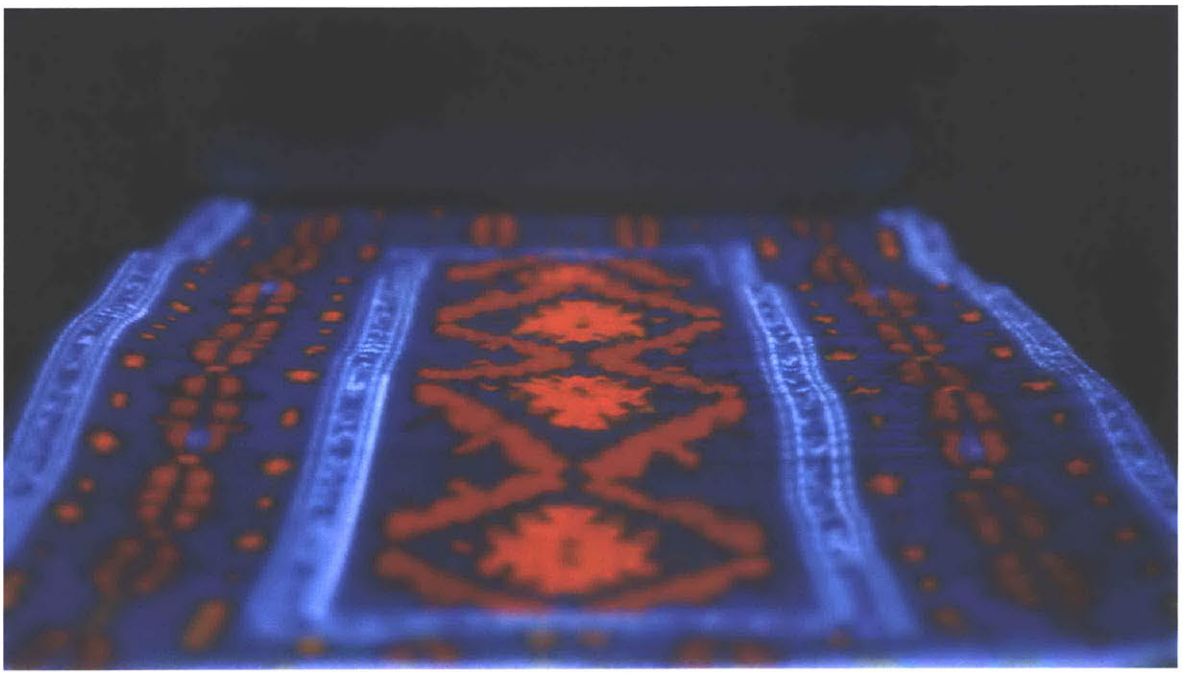

Figure 22.

Lightweaver
2017
Azra Akšamija (Project author), Joshuah Jest (Installation design and animation)
Digital animation projected onto textile

Similar to *The Colony*, and *Digital Terrarium*, *Lightweaver* takes advantage of the texture of the physical object to add detail and richness to the animated projections.

Lightweaver is also a prime example of integrated media design, as the logic for the accompanying animation were drawn from the material and scale of a specific textile. The result is palimpsest of weaving of various animated elements that seem to trace inside the heft of the cloth itself.

Conclusion

The Virtual

What is the virtual? This is a highly-debated topic, the roots of which trace back to Plato and his attempts to define the relationship between abstract thought and physical reality. [46] For the purposes of this paper, the Oxford English Dictionary's definition of the virtual, as outlined by Rob Shields, provides the best starting point:

> ***Virtual*** (adj.): Anything, "that is so in essence or effect, although not formally or actually." [47]

Figure 23. William Michael Harnett, *Still life Violin and Music,* 1888

Deconstructing the definition helps to understand the value and shortcomings of the virtual. *Essence* – the virtual is only part of a thing, maybe even the most important part of a thing, yet not the complete thing, e.g., the surface of an object rather than the total object. *Effect* – the virtual can even be the result or product of a thing, not the thing itself, e.g., the light reflected by an object rather than part of the actual object. *Not formally* – the virtual is not in accordance

[46] Plato. *The Republic and Other Dialogues,* trans. Benjamin Jowett (New York, Barnes & Noble, 2013).

[47] Rob Shields. *The Virtual.* (London: Routledge, 2003). 2.

with the rules or etiquette of reality, e.g., virtual models may behave outside the laws of physics. Additionally, formally can be taken to mean matters of physical form, reinforcing the fundamental immaterial nature of the virtual. *Not actual* – the virt-ual is opposed to the act-ual, it is not fact, not real, not truth, not genuine, not authentic, not verified, not confirmed, not definite. The value of the virtual lies in its lack of limitations, but this freedom comes at the cost of a fundamental separation from the truth and material of reality.

However, even with this fundamental separation, the virtual can still approximate reality, and is typically more useful when it does. The most valuable virtual realities, or virtualities, are those that most closely approximate reality before allowing for useful departures thereof, e.g., mathematical models of physics have been developed to correspond as precisely with reality as possible, allowing for mathematical departures within the models (theoretical physics) to lead to correlating phenomenon when tested in reality.

Figure 24. Andrea Mantegna, *Oculus on the Ceiling of the Spouses Chamber,* 1474

Figure 25. Pere Borrell del Caso. *Escaping Criticism*, 1874

How closely a virtuality matches reality depends on the qualities (essences) of reality chosen as the basis of the virtuality. A virtuality may be very similar to reality when evaluated in terms of a specific quality, but will be very different from reality when evaluated in other terms. For example a picture of a dog is similar to a real dog in terms of visual presentation from a specific viewpoint, yet the ink and paper that make up the image are very different from a real dog.

Clarifying the terms in which the virtuality is to be understood is equally important as choosing the terms on which the virtual is to be constructed. Failure to communicate the terms of a virtuality can lead to false secondary—often literal—interpretations, or media illiteracy. [48] E.g., how many young children believed that the people and characters depicted on television actually lived inside the fixture. These secondary readings are often unintended, but as with any asymmetric information flow, they can be easily exploited with intent.

[48] Hobbs, Renee. "Multiple Visions of Multimedia Literacy." *International Handbook of Literacy and Technology*. (Mahwah, NJ: Lawrence Erlbaum Associates, Inc., Publishers, 2006).

Even the readings of classical paintings could be exploited in such a way. While the art of painting had sought to recreate the beauty of reality, they had always been read as such – recreations. However, once Renaissance techniques of forced perspective and depth were combined with architectural integration, paintings entered an uncanny valley. The virtual nature of illusionistic ceiling paintings augmented reality, but only in visual terms. Still, visual terms make up a significant proportion of the information people use to evaluate reality. In the context of architecture and ornament, which is typically only seen and not felt, false visual information can go a long way. Tromp l'oeil techniques were used to inflate the perceived wealth and majesty of the church and the bourgeoisie by virtually extending upon the already awe-inspiring architecture with additional embellishments, fine pottery, statues, greenery, trophies, and angels. The line between the real and the virtual was purposefully blurred, as the virtual ranged from unassuming textures and embellishments to God himself, and it was all out of reach – either physically or socially.

With video and augmented reality devices consuming the majority of our time, what will it be like when these technologies can sustain a complete illusion—when a virtual object can be completely indistinguishable from its physical counterpart? Is it even reasonable to assume this situation will ever become possible, or is it just another case of overly optimistic sci-fi driven techno-determisim? To interrogate the idea further, one must break down the question, as there can be no definitive answer to an ill-defined question.

For an object to be indistinguishable from another it must present itself and behave in the exact same way. Any difference in presentation or behavior would otherwise be used to distinguish an object from the other. For example, a yellow two-by-four Lego brick would be completely indistinguishable from most other yellow two-by four Lego bricks. If

thrown into a tub of other yellow two-by-four pieces it would be virtually impossible to retrieve the original piece. Each brick would look the same, weigh the same, display no distinguishing marks, and function identically to any other. Furthermore, the bricks would also taste the same, smell the same, and for most intents and purposes, essentially *be* the same.

As follows, for a virtual object to be indistinguishable from its physical counterpart, it would have to present itself and behave in the exact same way. Modern technology is nowhere near simulating a virtual object that is indistinguishable from a real counterpart, as addressed earlier. However, modern technology is *closest* to simulating a virtual object that is *visually* indistinguishable from reality. Static rendering is basically there, but within a printed page or on a digital display. With contemporary "4K" graphics, ultra-high definition texturing, the most advanced volumetric light shaders and environmental effects, modern gaming platforms are just behind static rendering, but they also allow for two more degree of interrogation: space and time. Viewers can move around, allowing virtual objects to continually change their presentation in accordance to movement on behalf of the viewer, presenting in many additional ways as a real object would but still without physical tangibility. Haptic feedback technology is rudimentary, and nowhere near the fidelity of reality, similar to feeling the world through very thick gloves. But if one was only expecting to feel the world through thick gloves, it might be the perfect illusion. In the same regard, how many objects in one's surrounding does one actually touch on a day-to-day basis?

The long-term goal of my research is not to achieve the perfect illusion, or the much sought after total *Recreation of Reality*, but rather to anticipate and understand the consequences of such an accomplishment. [50] What would become of a society if it reached such an achievement? Would every human with access to such a technology simply fade away, succumbing to an infinite jest, broken by the recursive auto-stimulus of living in one's own mind rendered external? Would civilization grind to halt, persisting only to sustain the resources necessary to support a population of individuals retreating into isolated virtual worlds to live as gods, as in so many works of science fiction? Or will an infinitely fractured society live on within a rhizomatic nesting of realities, each with their own definition of truth? What would be the foundation—the common understanding on which a society is built—in such a world if not a shared plane of existence? Such extremes are farfetched, but distill long-present and emergent questions regarding truth, facts, and the ways in which we define and shape reality.

We will not put an end to projection, to answer a sensational question quixotically posed by Dominique Païni, nor will we ever put a definitive end to a media technology of any kind. We can, however, look forward, and establish good practices while technologies that promise only to further envelop our world are still in their infancy, before we lose sight of reality and before we lose sight of each other. [51]

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[50] Noël Burch and Ben Brewster, *Life to Those Shadows.* (Berkeley: University of California Press, 1990), 6.

[51] Dominique Païni,, "Should We Put an End to Projection?" trans. Rosiland E. Krauss. *October* 110 (2004): 23-48. doi:10.1162/0162287042379838.

Epilogue

The difference between the world in our heads and the world in which we find ourselves is the engine that drives humanity.

We create virtual worlds—models, toys—in the image of our own reality that serve both to edify and to entertain. In turn, we then modify our own world to fit the likeness of our imaginations. This recursive process is creation in the digital age: the proliferation of derivatives and iterations *ad infinitum*. We witness a perpetually asymptotic approach of the virtual to the real and vice versa, collapsing the quantum universe into existence in the everlasting pursuit of an unattainable complete physio-virtual convergence.

The Megatrend and Divine Singularity

The advance of civilization has at times been driven by the human impulse to alter reality: to bend the world to the individual's will and to make thought into reality. But it takes a great deal of coordination and energy to translate thought into reality. Throughout history, humanity has made great progress in creating and streamlining systems of coordination, expanded its domain of manipulation to include more materials at increasingly larger and smaller scales, and continued to refine techniques in order to reduce the energy required both to coordinate and to physically alter reality.

Through the use of semiotic proxies—namely, symbols and language–we have been able to express our thoughts more quickly and with greater accuracy. As an extension of language, the virtual world of digital information and simulation has also made great improvements to the speed and accuracy with which we articulate, measure, and record our minds and the world we share. Moreover, this digital space has extended the potential of the virtual far beyond the capacity of the human mind or physical texts. Today we have the technology to model any given environment with billions of points of spatial and color data inside a few hours, and "self-driving" cars are using similar technologies to "see" their environments, taking in reality in an instant, almost as fast as the human mind can. Because they rely increasingly on computation, matters of logic, law, medicine, art, economics, communication, and science are becoming ever more virtual. "Smart" technologies, the Internet of Things, drone-mounted cameras, and ill-defined "app permissions" are just a few of the digitalization techniques racing to ingest all aspects of existence, often without

any specific applications in mind. [52] I refer to this this trend of compulsory virtualization, which can be found in almost all disciplines, as *the* Megatrend. The term refers to one side of a two-sided phenomenon, the side of the virtualization of the real.

In contrast to the Megatrend is the realization of the virtual. The recursive refinement of various tools has made it possible for individuals to manipulate their environments with increasing speed and accuracy. We have transitions from working with wood and stone to metals and plastics, from silicon to nanomaterials, and more recently, the building blocks of life itself. [53] Assisted by successively more efficient hardware, the processes of fabrication are also taking less time than they once did. In mediaeval Europe, it might take nearly 600 years to complete the construction of a cathedral, whereas in modern times, similar feats can be realized inside of four years .[54] At a smaller scale, the jumps are even more significant, with modern manufacturing facilities, rapid prototyping machines, and engineered materials reducing the time it takes to bring physical objects into reality from days to hours and hours to minutes.

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[52] In practice, "all aspects of existence" are not being ingested; instead, data that can be used for profit is prioritized.

[53] Bangwei Zhang, "On Typical Materials Acting as the Dividing Standard of the Development Stages of Human Substance Civilization," *INDECS* 10, no. 2 (2012): 114-126. https://www.indecs.eu/2012/indecs2012-pp114-126.pdf

[54] Typically projects that took this long suffered from significant funding delays, or structural failings. Even so, at the time even most reliably-funded and well-equipped cathedrals could take 25 years to complete, as was the case with the Chartres Cathedral. "Sacred Destinations: Historic Cathedrals," *Ancient Megastructures*, accessed February 28, 2018, http://natgeotv.com/ca/ancient-megastructures/q-and-a.

Accordingly, the accelerating fronts of design and fabrication are significantly decreasing the time between inception and physical realization. The unification of bits and atoms is a great prospect, and one humanity and Neil Gershenfeld will continue to chase far into the future. However, does this progression present a problem when taken to its terminal extreme? What happens if the process of creation becomes instantaneous: if we attain God-like command over the physical domain by uniting mind and matter? Will this result in some sort of auto-neurotic feedback loop that will drive us mad or keep us hopelessly pacified? Will we cease to reflect, or will we still pause, resting on our seventh day to behold the beauty—or lack thereof—of our creation? Will we even create anymore or will we just consume?

The literal realization of the divine singularity is often used as a helpful thought experiment, but the concept could soon be realized virtually. A similar phenomena has already come about in the form of neurofeedback, or "NFB". The process translates brain activity, typically via electroencephalography (EEG) readings, into visual patterns of light, color, and sound. Through this process, a person can in some respects experience their own brain as it experiences itself. Experimental use to treat hyperactive neural activity and related afflictions, including ADHD, anxiety, schizophrenia, Tourette's syndrome, and epilepsy. [55] Might the instantaneous virtualization of imagined realities bring about similar or more extreme effects?

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[55] For NFB and its role in treating ADHD, see "How the American Academy of Pediatrics reached the conclusion that EEG Biofeedback, (aka Neurofeedback) is a Level 1 Evidence-Based Practice for Attention and Hyperactivity, and other recent evidence of the efficacy of Neurofeedback for ADHD," BrainTrainUK (2012), April 9, 2016, http://www.braintrainuk.com/wp-content/uploads/2013/07/How-AAP-reached-conclusion-other-recent-evidence-July-2013-V3.pdf. (Citations continued on next page)

Assuming we are not instantly driven mad by the sight of our own mind seeing, we will become demi-gods in our own private domains, but only so much as we are already clumsy demi-gods in virtual environments that exist today. Will we stay, succumbing to omnipotence even more severely than we succumb to video game addiction today? [56]

Or, maybe our deeply engrained pack instincts will save us, by driving us back to a shared reality just for the company.

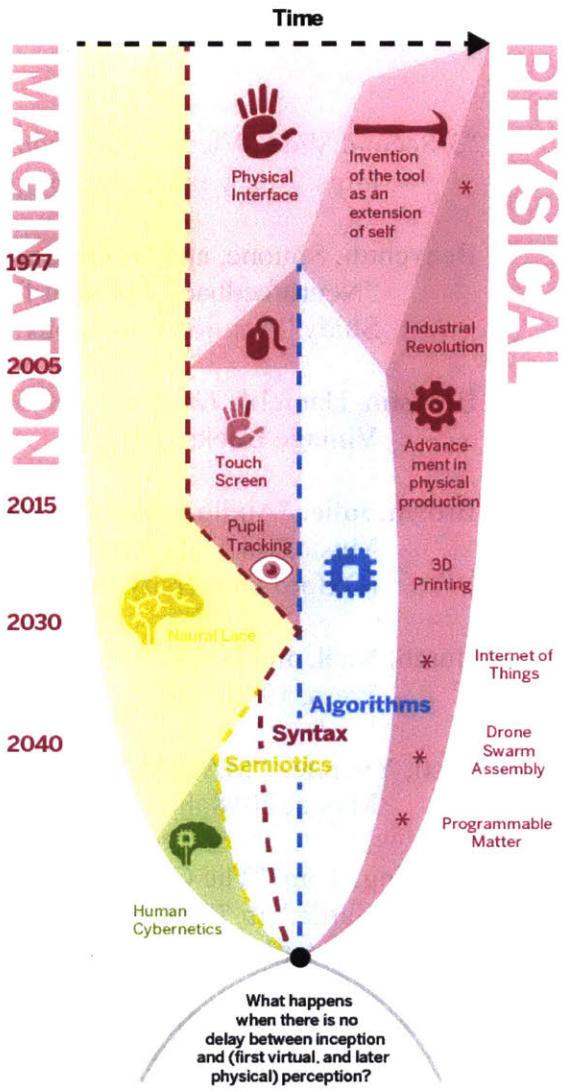

Figure 26. Joshuah Jest.
Infographic outlining the Divine Singularity.
2013.

[55] See also Arlene Karidis, "Neurofeedback – The Scientific Evidence Grows," Perth Brain Centre. Accessed April 9, 2016; Tanju Surmeli, "Schizophrenia and the Efficacy of qEEG-guided Neurofeedback Treatment: A Clinical Case Series," Living Health Center for Research and Education presentation in Istanbul, Turkey. 2012, http://neurofeedback.csusb.edu/documents/Schizophrenia%20and%20the%20Efficacy%20of%20NF%20-%2Turkey.pdf; Simone Benvenuti, Giulia Buodo Messeratti, Valentino Leone, and Daniela Palomba, "Neurofeedback Training for Tourette Syndrome: An Uncontrolled Single Case Study,"Applied Psychophysiology and Biofeedback 36, no. 4 (2011): 281-88.; and Gabriel Tan, John Thornby, D. Corydon Hammond, Ute Strehl, Brittany Canady, Kelly Arnemann, and David A. Kaiser, "Meta-Analysis of EEG Biofeedback in Treating Epilepsy," *Clinical EEG and Neuroscience* 40, no. 3 (2009): 173-79.

[56] Charlotte Thoresen Wittek, et.al., "Prevalence and Predictors of Video Game Addiction: A Study Based on a National Representative Sample of Gamers," International Journal of Mental Health and Addiction 14, no. 5 (2015): 672-86.

Bibliography

"3-Second Video Views." *Facebook.* Accessed January 17, 2018. https://www.facebook.com/business/help/743427195703387.

Benvenuti, Simone, and Giulia Buodo Messeratti, Valentino Leone, and Daniela Palomba, "Neurofeedback Training for Tourette Syndrome: An Uncontrolled Single Case Study,"Applied Psychophysiology and Biofeedback 36, no. 4 (2011): 281-88.

Boorstin, Daniel J. *The Image: A Guide to Pseudo-Events in America*. New York, NY: Vintage Books, 2012.

Brown, Julie. "Audio-visual Palimpsests: Resynchronizing Silent Films with 'Special' Music," in The Oxford Handbook of Film Music Studies, ed. David Neumeyer (Oxford University Press, 2014), 588.

Burch, Noël, and Ben Brewster. *Life to Those Shadows*. Berkeley: University of California Press, 1990.

Festl, Yvonne. "MAD MAX: FURY ROAD." *Cinemetrics*. October 27, 2015, accessed May 5, 2018, http://www.cinemetrics.lv/movie.php?movie_ID=18994.

Gunning, Tom. "The Cinema of Attraction[s]: Early Film, Its Spectator and the Avant-Garde." In *The Cinema of Attractions Reloaded*, edited by Wanda Strauven, Amsterdam University Press, (2006). 381-88.

Herbert, Stephen. "Who Painted the Discs?" COMPLEAT EADWEARD MUYBRIDGE. January 28, 2009. Accessed February 07, 2017. http://www.stephenherbert.co.uk/muy blog3.htm#part15.

Hobbs, Renee. "Multiple Visions of Multimedia Literacy." *International Handbook of Literacy and Technology*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc., Publishers, 2006.

"How the American Academy of Pediatrics reached the conclusion that EEG Biofeedback, (aka Neurofeedback) is a Level 1 Evidence-Based Practice for Attention and Hyperactivity, and other recent evidence of the efficacy of Neurofeedback for ADHD," BrainTrainUK (2012), April 9, 2016, http://www.braintrainuk.com/wp-content/uploads/2013/07/How-AAP-reached-conclusion-other-recent-evidence-July-2013-V3.pdf

Hyun Lee, Seung, Jeongjin Kim, Jung Ho Shin, Han Eol Lee, Il-Suk Kang, Kiuk Gwak, Dae-Shik Kim, Daesoo Kim, and J Lee. "Optogenetic Control of Body Movements via Flexible Vertical Light-Emitting Diodes on Brain Surface." *Nano Energy* Vol. 44 (February 2018): 447-455. https://doi.org/10.1016/j.nanoen.2017.12.011.

Jeffrey M. Jones, "In U.S., 40% Get Less Than Recommended Amount of Sleep," Gallup.com, December 19, 2013, accessed December 20, 2015, http://news.gallup.com/poll/166553/less-recommended-amount-sleep.aspx.

Johnston, Ollie, and Frank Thomas. *The Illusion of Life: Disney Animation*. New York: Disney Editions, 1981.

Jonas, Jost B.; et al. "Human Optic Nerve Fiber Count and Optic Disc Size". *Investigative Ophthalmology & Visual Science* 33 (May, 1992): 6

Karidis, Arlene. "Neurofeedback – The Scientific Evidence Grows," Perth Brain Centre. Accessed April 9, 2016

Lavin, Sylvia. *Kissing Architecture*. Princeton, NJ: Princeton University Press, 2011.

Metzger, Wolfgang. "Optische Untersuchungen am Ganzfeld." Psychologische Forschung 13 (1930): 6-29.

Merleau-Ponty, Maurice. *"An Unpublished Text." In The Primacy of Perception, and Other Essays on Phenomenological Psychology, the Philosophy of Art, History, and Politics*. Evanston, Ill.: Northwestern University Press, 1964

Meeker, Mary. "Internet Trends 2015 v3". Presentation. Kleiner Perkin Caufield Byers. May 27, 2015. http://www.kpcb.com/internet-trends.

Mitoma, Judy, Elizabeth Zimmer, and Dale Ann Stieber. *Envisioning Dance on Film and Video*. Florence: Taylor and Francis, 2013.

Parikka, Jussi. "A Geology Of Media And A New Materialism." *Digital Culture & Society* 1, no. 1 (2015). doi:10.14361/dcs-2015-0113.

Postman, Neil. *Amusing Ourselves to Death: Public Discourse in the Age of Show Business*. New York, NY: Penguin Books, 2006.

Roche, Lorin. "Come to Your Senses." Meditation 24-7. Accessed February 24, 2018. http://www.meditation24-7.com/page18/page18.html.

"Sacred Destinations: Historic Cathedrals," *Ancient Megastructures*, accessed February 28, 2018, http://natgeotv.com/ca/ancient-megastructures/q-and-a.

Shields, Rob. *The Virtual*. London: Routledge, 2003.

Shteynberg, Garriy, and Evan P. Apfelbaum. "The Power of Shared Experience: Simultaneous Observation With Similar Others Facilitates Social Learning." *Social Psychological and Personality Science* 4, no. 6 (2013): 738-44. Accessed April 9, 2018. doi:10.1177/1948550613479807.

Splane, Lily. *Quantum Consciousness: A Philosophy of the Selfs Potential through Quantum Cosmology*. San Diego, CA.: Anaphase II Publishing, 2004.

Surmeli, Tanju. "Schizophrenia and the Efficacy of qEEG-guided Neurofeedback Treatment: A Clinical Case Series," Living Health Center for Research and Education presentation in Istanbul, Turkey. 2012, http://neurofeedback.csusb.edu/documents/Schizophrenia%20and%20the%20Efficacy%20of%20NF%20-%2Turkey.pdf

Sutton, Gloria. *The Experience Machine: Stan VanderBeek's Movie-Drome and Expanded Cinema*. Cambridge, MA: MIT Press, 2015.

Tan, Gabriel, and John Thornby, D. Corydon Hammond, Ute Strehl, Brittany Canady, Kelly Arnemann, and David A. Kaiser, "Meta-Analysis of EEG Biofeedback in Treating Epilepsy," *Clinical EEG and Neuroscience* 40, no. 3 (2009): 173-79.

Turner, Fred. *The Democratic Surround: Multimedia & American Liberalism from World War II to the Psychedelic Sixties.* Chicago, IL: The University of Chicago Press, 2013.

Turner, Lawrence. "21 Senses or More!" *Unique Design*. Accessed April 01, 2016. http://www.unique-design.net/library/word/sense.html#7.

Wittek, Charlotte Thoresen, et.al., "Prevalence and Predictors of Video Game Addiction: A Study Based on a National Representative Sample of Gamers," International Journal of Mental Health and Addiction 14, no. 5 (2015): 672-86.

Wood, Derek. "The Diorama in Great Britain in the 1820s". History of Photography, Vol 17, No.3. 1993. p. 284-295 Web. 21 Aug. 2016. http://www.midley.co.uk/

Yantis, Steven. *Visual Perception: Essential Readings*. Philadelphia, PA: Psychology Press, 2001.

Yurek, Jeff. "How Much Color Gamut Do Displays Really Need? Part 2: How We Perceive Color." *Dot-color*. July 16, 2014. https://dot-color.com/2013/07/16/how-much-color-gamut-do-displays-really-need-part-2-how-we-perceive-color/.

Zhang, Bangwei. "On Typical Materials Acting as the Dividing Standard of the Development Stages of Human Substance Civilization," *INDECS* 10, no. 2 (2012): 114-126. https://www.indecs.eu/2012/indecs2012-pp114-126.pd

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