

The Aesthetics of Liminality: Augmentation as Artform

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ABSTRACT

From ARToolkit's emergence in the 1990s to the emergence of augmented reality (AR) as an art medium in the 2010s, AR has developed as a number of evidential sites. As an extension of virtual media, it merges real-time pattern recognition with goggles (finally realizing William Gibson's sci-fi fantasy) or handheld devices. This creates a welding of real-time media and virtual reality, or an optically registered simulation overlaid upon an actual spatial environment. Commercial applications are numerous, including entertainment, sales, and navigation. Even though AR-based works can be traced back to the late 1990s, AR work requires some understanding of coding and tethered imaging equipment. It was not until marker-based AR, affording lower entries to usage, as well as geo-locational AR-based media, using handheld devices and tablets, that augmented reality as an art medium would propagate. While one can argue that AR-based art is a convergence of handheld device art and virtual reality, there are intrinsic gestures specific to augmented reality that make it unique. The author looks at some historical examples of AR as well as critical issues of AR-based gestures such as compounding the gaze, problematizing the retinal, and the representational issues of informatic overlays. This generates four gestural vectors, analogous to those defined in "The Translation of Art in Virtual Worlds," which is examined through case studies. From this, a visual theory of augmentation will be proposed.

The Overlay and the Retinal

In the creation and "performance" of augmented reality (AR) works, two actions occur: those of gaze and those of gesture/positionality. The reason for separating them, although they are related, is that in the five modalities/gestures that I wish to discuss (fiducial, planar, locative, environmental, and embodied), there are different relationships between the user, the augment, and the environment. In the experience/performance of AR, there is placement of one or many elements between the eye and the recognized target, as well as the gaze of the agent in experiencing the piece. I will refer to the AR media in question as a "piece" or "installation," since this discussion has to do with art, though exceptional commercial examples will be included. In "The Translation of Art in Virtual Worlds" [1], I defined gestural lines of intent, or "vectoral gestures," as being lines of flight between the origin of the work and the site of the intended audience. These consisted of four modalities: being wholly in the physical or virtual, or gesturing from one to the other (or a combination). Thus, AR consists of a different set of configurations.

AR's inherent difference from VR is that although there is virtual content, that content is overlaid upon a visual representation of the physical. It would be simple to theorize an intermediate plane of representation between the viewer and the target, as in the case of the planar modality, but unfortunately, AR is not that straightforward. Depending on modality, there could be a space-matrix of locative or interactive media, a space imposed on a marker, as well as one or more spatial planes between the viewer and the target (as in print, which I will discuss as the fiducial and planar).



AR consists of spaces of positional overlays, whether locative or recognized, and a performative gestural gaze, especially in the case of goggles or handheld/tablet works, as in the case of Darf Design's *Hermaton*. In addition, I would like to consider Duchamp's idea of the "retinal" and propose an argument for his *Fountain* being a predecessor to augmented art in 1917, with the addition of his signature [2]. However, this comes into play only after considering what I will call overlay-space.

The space of AR is peculiar in that it is representationally fluid, dependent on many factors. Depending on modality—fiducial, planar, locative, environmental, or embodied—the relationship of the viewer's position to the subject can be relative, interactive, or locative. For example, consider a user in a geolocative installation with an iPad. Any medium is relative to the viewer's location, point of view, and how the infocet overlays itself on the "picture plane" of reality, as represented by the device's camera and the AR application. Consider, if that medium is dynamic when interacted with, the chain of signification separates from what Duchamp called the "retinal," and even from the haptic as well. The relationship of the viewer, landscape, and media infocet compounds the point of view through multiple points of interest (POIs) in the landscape, sliding into a Massumian constant state of becoming of the subject [3], as the relation of the viewer to the multiple planes of subject constantly reconfigure into a new positionality. These are, in the case of locational and interactive AR, the problems posed by the fluidity of becoming-signification in relation to the landscape or *mise-en-scène*. In the case of the planar mode of augmentation, the target is often static and the relation is a simple overlay of the augment over the given recognized signifier. Now that I have alluded to the complexities of the relation to media in augmented spaces, their modalities are subject to study.

The Structure of the Gesture in Augmented Reality Art: Fiducial, Planar, Locative/GPS, Environmental and Embodied/Wearable

Augmented art is actually a catchphrase for a number of different technologies for overlaying virtual content on actual scenery, coined by Caudell and Mizell at Boeing in 1992 [4]. I will propose five categories of augmentation, and if any are overlooked, I hope it will be because of new developments. These techniques consist of the five categories mentioned above (fiducial, planar, locative/GPS, environmental, and embodied/wearable). While these categories overlap or have indistinct boundaries—such as the intersection of the fiducial and planar recognition—they give the critical scholar studying augmentation a discursive toolset. Each of these modalities situates the viewer, content, and overlaid environment in ways that create specific gestures of media delivery.

When discussing gestures in AR, I refer to two of my other essays that take a similar analysis in examining virtual media: "The Translation of Art in Virtual Worlds" [5] deals with art in virtual reality, and "Art in the Age of Dataflow" [6] examines the development of electronic literature since Joseph Frank's theory of spatial literature in the 1940s [7]. I posit origin and content in spatial literature, following Arakawa and Gins' concept of a "landing site" [8] for the augmented gesture, which is a destination in a process of communication, but not necessarily a basic sign/signifier relationship. In AR, although there *can* be simpler situations between the viewer and media, such as planar recognition video overlays, there are others such as dynamic media in GPS-based/locative installations. These include Darf Design's *Hermaton* installation. As discussed in "The Translation of Virtual Art," the AR gesture varies in its relationship between origin and receiver, from double signification in the case of fiducial and planar, to a dynamic semiotic matrix of constant becoming-meaning in the case of GPS/locative applications. This essay will progress from a more basic/historical framing of AR mediations and 2D situations,

moving into more complex sites of engagement, with the understanding that there will be examples that overlap and double within categories. These are presented as propositions used as “handles” from which a discussion of the different forms of augmentation can be formed.

The AR “gesture” consists of a line of attention/flight between the interactor and the superimposed media overlaid on the environment, such as attention given to a piece of media situated in 3D space, or orientation, as in the case of fiducial tracking. The semiotic relationship between the interactor, the environment, and the augment becomes complex, as simple media overlays become multi-faceted interactive experiences that create dynamic augmented spaces.

Fiducial AR

One of the earlier forms of augmented reality uses a specific digital, or fiducial, marker that gives a unique signature to an objective “seen” by a computer camera. This was the primary form of tracking in the works I first saw in the mid-to-late 1990s, especially work using the ARToolKit and work coming from ATR Kyoto. The fiducial marker gives information for six degrees of orientation and locates the AR content easily in 3D space. My introduction to AR was Berry and Poupyrev’s *Augmented Groove* [9], developed at the ATR Kyoto research lab. This work was an augmented DJ station in which participants could make audiovisual mixes through the manipulation of vinyl albums with fiducial markers printed on them. In the documentary video, the user is presented with a character sitting atop the dial on the record, which changes orientation/values through orientation. ARToolkit is the product of Hirokazu Kato of the Nara Institute of Science and Technology in Japan, created in 1999. It is a series of libraries allowing programmers to orient media to fiducial markers relative to their appearance through a webcam or other optical input device. By the mid 2000s, overlay media included animated 3D content, such as Japanese virtual pop idol Hatsune Miku.

Hatsune Miku is the realization of the autonomous virtual pop idol, envisioned in the character of Rei Toei by William Gibson in his *Bridge Trilogy* [10], in that “she” was released as a character representing a text-to-song program called Vocaloid [11] in 2008. Based on Yamaha’s text-to-speech technology, Hatsune Miku is the first in a series of Vocaloids to utilize granular synthesis of sampled vocalists. What would follow was a series of fan music videos, especially after the release of *Miku Miku Dance*, a character animation program starring Vocaloid characters. This would reach its apex in a large-scale music concert using stage holography developed by UK company Musion, which also developed the Virtual Tupac spectacle at Coachella 2012 [12].

The virality of the Miku/Vocaloid technology made her the ideal subject for an “AR companion.” Since 2009, numerous fan-generated Miku demos based on fiducial markers on paddles emerged, even to the point of applications using the Oculus Rift headset to let you “live with” or sleep alongside Miku. This is more in the realm of the environmental, or even embodied/wearable, gesture of AR, and is more advanced than the GPS/geolocative, placing the augment in space through *environmental feature recognition* rather than accessing an external GPS database of points of interest.

New York artist Mark Skwarek creates uses for the embodied fiducial marker. The first is his *Occupy Wall Street AR* project [13]. This intervention took place *in front* of the Stock Exchange, which is notable because interventions and protests were only allowed in privately held Zucotti Park. The intervention was documented as passers-by donned a helmet with a marker, and when they viewed themselves with the front-aiming camera, they would see the engraved portrait of George Washington from the US one-dollar bill instead of their head. Skwarek would reprise

this idea in his *Virtual Halloween Masks* [14], where anyone could download a given marker and app, and appear with a skull or jack-o-lantern head. These are both playful applications of the fiducial gesture.

Planar/Recognition

The gesture of the planar/feature recognition augment is a superset of the fiducial modality, though similar to the marker in that it exists on a surface. I specified the fiducial for its historical significance, but the planar/print/poster form of AR exhibits a broader scope than the digital marker and often performs a more straightforward function. In a TED talk presented in 2012 by Aurasma AR technology creators [15], Matt Mills and Tamara Roukaerts demonstrated the recognizing gaze by aiming a mobile device at an image of Scottish poet Robert Burns. Upon doing so, an overlaid video of an actor, approximating the *trompe l'œil* of the painting, appeared. While more sophisticated than the fiducial gesture, AR feature-recognition of media is an overlay of content onto planar media; for example, a recent IKEA catalog that allowed users to place virtual furniture in their apartment; or video overlaid in a Costco circular. All of these augments are either simpler than or equal to a fiducial modality, creating a simple semiotic swap.

One other campaign executed through the planar mode of augmentation stands out for its utility of testing the medical aptitude of a public audience. Creative agencies VML and GPY&R Melbourne's 2012 *Mobile Medic* campaign for the Australian Defence Force [16] consists of a public poster with recognition and augment markers in the image. Potential recruits would perform triage on the mediated "patient" in the poster, and submit their diagnoses and strategies for treatment by analyzing the embedded X-Rays, vital sign waveforms, and media. The Defence Force immediately contacted those who scored highest in the "game" as possible recruits for their medical corps. This is another example showing how, when combined with developing aspects of interactivity, the planar AR experience is maturing. But as we unpack the representational modes of AR outward from interacting with planar media, the user encounters AR in spaces. This is where the environmental, geolocative, and embodied/wearable modalities of AR emerge. The difficulty with studying these forms of mediation and interaction is that they engage space in different, but equally valid, ways. Because environmental recognition is more similar to the planar/fiducial than the geolocative or embodied AR, this will be our next category.

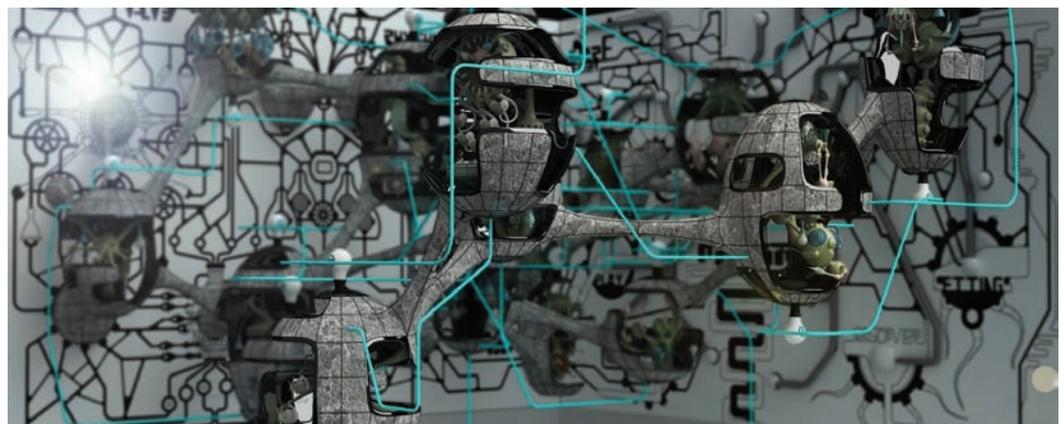


Figure 1. *Hermaton*. Image courtesy of Darf Design, 2013.

Environmental/Planar Recognition

The next recognition challenge that arises is scanning space from a given point of view. This introduces many issues, from perspective to time of day, weather, or occluding bodies in the scene. This has largely left the application of environmental AR to indoor applications with fewer variables. However, outdoor applications, in regards to machine repair, are part of the original Boeing concept and military applications [17]; but these are close-range situations with very specific, regular spatial configurations. Environmental/spatial recognition applications on an embodied or architectural scale present more variables and challenges for tracking the environment. Here I will present examples that will expand in size, and explore a couple of examples of intimate environmental experiences that refer to earlier examples.

Hermaton [18] is an environmental AR game developed by London-based Darf Design, founded by Sahar Fikouhi and Arta Toulami, that uses a half-room-sized cut vinyl mural as marker when presented at an environmental size (Figure 1). There is a “tabletop” version which uses its own marker, that fits into an advanced category of the feature-recognition category; but for our conversation, the room-sized version is more germane. Darf Design’s project statement describes *Hermaton*:

The project uses a “buzz wire” maze (think: the children’s game “Operation”) which people can navigate through in real-time, attempting to interact with the digital objects of the “Hermaton” machine. The design of this environment provides both an interactive and performance space which allows the user to fully immerse in a new augmented physical landscape [19].

The user controls a small red ball through the maze-like machine, switching on its lights and progressively activating the *Hermaton*. In addition, the user is placed in a “performative” media space [20] where the body has to physically stretch, crouch, and twist through the virtual machine. Where the line exists between performance and performativity in media art, including AR, is at the implication of audience. In the case of environmental AR, there is a becoming-action in navigating the work, but the presence or absence of audience in the space is purely incidental, though the space is activated.

Two examples of larger architecture-based AR installations are the Heavy Projects’ *AR Murals* [21] and my own large-scale *AR Tapestries* [22]. Each deals with architecture and the cultural histories of the form (the mural and the tapestry) to create a context for the content. By far, Heavy Projects has the larger body of work, as they activate building murals by turning them into the centerpiece for spectacular AR installations. The most notable of these projects were the five murals Heavy augmented and animated at Art Basel Miami 2012 (by How and Nosh, Aiko, Retna, Ryan McGinness, and Momo), as well as one mural that Shepard Fairey had recently repainted, restored via AR. In Ryan McGinness’ mural (the most frequently reproduced of the set), the colorful Haring/Leger-like landscape of bodies formed a frame, and jets of color spewed out of the side of the building. Such a simple gesture as the McGinness mural illustrates the environmentally transformative quality of AR when taken to scale.

The five-by-twenty-one-foot Jacquard-woven tapestry *Into the Wild/Virtual Kenai* is a panoramic composite, taken by me from a 2009 photographic project in Alaska on the Kenai Peninsula and Adak Island. The piece refers to historical works such as the *Bayeux Tapestry*, which depicts the Battle of Hastings, and the transformative nature of the Jacquard loom. The five-by-twenty-one-foot size represents the grandeur of the Alaskan landscape. For augment tracking, it uses QR codes as web links or fiducial markers, and features flocks of birds and sunlit highlights as

recognizable features (Figure 2). The content (doubly accessible in the case of the QR code) refers to the artist's experience of the Alaskan environment, as forces such as oil and mineral industries and global warming encroach upon this part of the world. *Into the Wild/Virtual Kenai* depicts another form of conquest: the Enlightenment-era notion of the human subjugation of nature, currently known as the Anthropocene Age [23]. In this way, this work frames itself in a historical context while still taking a critical stance. But other applications root themselves deeper in history, and reveal potentials for the power of environmentally-based AR.



Figure 2. Patrick Lichy, *Into the Wild/Virtual Kenai*. © 2014 Patrick Lichy.

Nathan Shafer's *Exit Glacier Terminus AR* reveals the retreating terminus of the Exit Glacier on the Alaskan Kenai Peninsula (Figure 3). *Exit Glacier*, created for interpretive rangers with the Kenai Peninsula National Park, is an application that recognizes the terrain from its own database, because there is little data connectivity at the site. Exit Glacier is unique in that it is one of only two walk-up glaciers, and the AR application shows five reconstructions of the glacier face from 1978 to 2013. The challenge of connectivity poses problems for most AR frameworks, but, conversely, the project's Alaskan self-sufficiency presents a kind of utility that is useful at the edge of the wireless world.



Figure 3. Nathan Shafer, *Exit Glacier Terminus AR*. © 2013 Nathan Shafer.

Between the Environmental and the Embodied: The Return of Hatsune Miku

The AR applications depicted so far range from interior architecture to the geologic in scale, but a peculiar subset of environmental applications have emerged in Japan, based again on our virtual pop idol Hatsune Miku. These works are situated between the environmental and the embodied/wearable modalities. They require a Kinect-like spatial camera linked to a headset—making them embodied—but are specifically about orienting the subject in the environment. The subject in question is Miku herself, and the applications are *Miku Stay*, a series of experiments in having Hatsune Miku as a happy, live-in girlfriend, and another that situates Miku as a sleeping partner.

In *Miku Stay* [24], created by “alsione svx,” Miku exhibits complex interactions like sitting in a chair (and impressively dealing with occlusion by walking *behind* it) and holding hands. Most of these are accomplished through spatial camera and fiducial markers, but eventually “alsione svx” mentions that he can’t stand using these anymore in the video, and uses environmental cues, such as chairs, as markers instead. Miku approaches, stands on the bathroom scale, holds hands, and then jumps, laughing merrily. *Miku Stay* is a feminist’s nightmare, as the app allows the user to live with a hopelessly idealized character unattainable in flesh and blood. If this were not problematic enough, the fan-created *Sleep Together* app [25] goes one step further: Miku becomes the user’s bed partner, calling them “Master” and comforting them if they are restless.

Awkward as this may seem, if we return to the gesture of locating the subject in space using environmental AR, we find that there is a *second* Miku-as-AR-girlfriend game: for the PS Vita by Sega, called *Hatsune Miku Project Diva F* [26]. The “song-masher” game (as I call the genre of musical coordination games like *Dance Dance Revolution*) includes a markerless AR app that allows Miku to hang out in your apartment. Is this the isolated *hikikomori*’s dream, or, as Josh Tolentino states in *Japanator*, “Mindless *waifu* gimmickry”? (*Waifu* is a fan term for idolizing an anime character as a possible mate.) *Hatsune Miku Project Diva F* is definitely in the realm of environmental AR, but the question remains: does AR suggest what Bruce Sterling calls a “design fiction” [27] to alleviate technological isolation?

Body As Landing Site: Wearable AR

In my 1999 essay “Towards a Culture of Ubiquity” [28], I trace a trajectory of how interaction/delivery of media/mediated reality would progress. First is the screen, then the hand (-held device), then onto the body, and then onto space and architecture. Although wearables and locative technologies have developed far more in-parallel than I envisioned, the trajectory seems on-track. There are multiple lines of creation happening that overlap, like the monocle/goggle AR solutions. One might argue that Google Glass fits here, but Glass and its contemporaries are more about hands-free wearable computing than about AR. These devices are emerging, but are also coming into being by tapping into the mass imagination through the use of design fiction.

In popular culture, the world of AR has moved from science fiction to “design fiction,” although there are excellent examples of AR as trope in books like William Gibson’s *Spook Country* [29], which features a subplot about AR artists depicting the deaths of celebrities at their place of demise. There are examples in film, including *Minority Report*’s dressed-up version of Oblong’s user interface [30]. However, science fiction is giving way to design fiction as a way to capture the popular near-future imagination. The leading design fiction involving the embodied AR gesture in 2013 was *Sight* [31], a dystopic AR fantasy film by Eran May-raz and Daniel Lazo. In the story, “Sight” technology has revolutionized life, from augmenting the contents of a refrigerator to turning such mundane tasks as cutting vegetables into a “Master Chef” game. The story darkens when the character Patrick goes out on a date, using Sight to choose the ideal wardrobe with his

“Wingman” app. After making a few gaffes, Patrick wins his date over—and we find out he is a programmer for Sight Systems. They go back to his apartment, and the date notices that Patrick forgot to turn off his scoreboard, sees that he has been using the Wingman, and storms off. This is not a problem, as he reveals that the secret feature of Sight is to be able to hack consciousness—and this is why most authors should not write their last chapter. Although *Sight* offers insights into the future of embodied AR, the worn trope of mind control sneaks in. It is also a commentary on technoculture’s growing distrust of what Sterling identified as the five global vertical monopolies, or “the Stacks” [32]. *Sight* is a commentary on Google Glass taken to its logical extent.

Two embodied AR platforms also begin with design fictions and are becoming more tangible—two sets of AR glasses competing for the imagination of the public, namely Meta and Atheer. The Meta AR platform was presented in the style of *One Day with Google Glass* [33] as *A Morning of Meta* [34]. I theorized eight years prior to this writing, in “An Alpha Revisionist Manifesto” [35], that in the future, companies would create pre-prototype narratives to create belief and desire. Sterling calls these “design fictions” to inspire funders, developers, and consumers into willing dreams into being. This video is an “alpha revision” proposition that secured crowd-sourced funding by showing prototypes in the form of the Meta glasses.

Atheer Labs also composed a compelling design fiction based around *their* glasses, in the same vein as Meta. The glasses show dynamic augments of the environment, streaming entertainment, and fluid communication, stressing creativity, entertainment, and productivity. Atheer is about a year behind in their crowdsourcing [36] and boasts a less expensive product than Meta’s proposed Second Generation Meta Pro glasses. Although we discuss the modalities of augmentation and the relationship of augmented media and users, it is interesting to note the “six months out” mentality, as well as the proof-of-concept videos versus the initial design fictions. Differences narrow as time goes on, but the reality of Google Glass was far different than the fiction depicted in *One Day with Google Glass*. Thus, design fictions—such as the PADD from *Star Trek: The Next Generation*, which became the iPad—seem to make the notion of science fiction less compelling, as Bruce Sterling claimed in 2014 [37].

Locative/GPS-based

The last gesture/modality in AR is the locative/GPS. This relates to the dynamic relationship between the user, the media linked to points of interest in the landscape, and the objective background upon which the media is overlaid. Many variables are in play as the relationship between user, media, and landscape—as in the environmental modality—and dynamic content creates a fluid matrix of representations, creating a sort of semiotic pinball machine. Fortunately, and perhaps disappointingly for the work itself, most locative AR work consists of overlaid imagery or video on static points of interest. I understand, as with all our gestural modalities, that there are commercial applications that have surpassed many of the artworks in our discussion in leveraging the potential of the medium. In addition, locative AR art constitutes the majority of the medium as art, so only a small number of works are discussed, with apologies to the remaining mass. I would like to discuss installations that address certain topics—politics and geographical annotation. Each throws content in useful or illegal/unexpected places, and creates a double signification of the location through overlay and context.

Political work is one of the smaller genres in AR, although interventions like *We AR MoMA* [38] have used AR to create *salons des refusées* inside prestigious museums without actually sneaking into the space and nailing the work to the wall. *Occupy Wall Street AR* [39], organized by Mark Skwarek for the collective ManifestAR, inserted “illegal” content over the Stock Exchange. The

illegality of the gesture is marked by the fact that during the Occupy Wall Street campaign, intervention was only permitted in privately-held Zucotti Park. So, collective members (Mark Skwarek, Alan Sondheim, et al.) “docented” the work to onlookers, as mentioned before, using iPads with Space Invaders, the Monopoly game Plutocracy, and slot-machine wheels between the columns of the Exchange, playing on Brian Holmes’ idea of “market as casino” [40]. In the Occupy AR interventions, the “infopower” is not constrained by material or, as I call it, “atomic” power [41]. As mentioned in a 2013 panel on “AR as Activism” at South by Southwest, the question was posed as to whether law enforcement could demand the reorientation of a locative database if it was representing protest in a restricted space. I revisited this question, penetrating controlled airspace with *Love Bombers*, which depicted NATO A-10 Warthog Bombers dropping video game hearts on the NATO summit and protesting mobs in Chicago (Figure 4).



Figure 4. Patrick Lichty, *Love Bombers*. © 2012 Patrick Lichty.

Another AR augment work that overlays historical content onto geographical environments is the 2012 Annette Barbier and Drew Browning collaborative project *Expose, Intervene, Occupy (EIO)* [42]. *EIO* used locative and recognition technologies to insert critical narratives into the downtown Chicago landscape. One of the eight AR collaborations was Barbier’s *2070*, which explored the invasion of the Asian carp into the North American Great Lakes through the Chicago River as an alternate historical street sign narrative. Where *Occupy AR* had more of a unitary format, *EIO* creates an “anthology” of works describing AR’s use as a tool for psychogeographic inquiry. Of note is the unfortunate fact that, due to the change in policy of companies providing the technological infrastructure, *EIO* is now inactive.

My last examples of historical or geographical transnarrative are *Virtual Duke* and *Digital Durham* [43], by Victoria Szabo and historian Trudi Abel. The projects seek to create historical media experiences, notably using Google Earth and AR in Version 3 to reveal reconstructed representations of the historical sites of Raleigh-Durham in AR using geolocative points of interest. At a 2012 SLSA presentation, the project appeared geolocatively, although the documentation site still remarks that the project is forthcoming in 2012.

Conclusion

By looking at augmented reality as a delivery method for artistic content, then investigating it as a frame for mediation, a discussion is opened up that ties deeply into art-historical tradition and novel modes of “becoming.” From Duchamp’s notion of the “retinal,” to pervasive imaging’s fracturing and multiplying the mediated gaze, AR and these proposed gestures/modalities of representation suggest ways in which artists are using AR in cultural production. By beginning with historical technologies like fiducial tracking, we can trace an epistemic arc as AR unfolds into image recognition, spatial location, and embodied interaction. As additional layers of interaction are embedded into AR in handheld and wearable units, more layers of signification are stacked into augments, as evidenced in the case of the *Mobile Medic* application. However, it is also important to note that AR as of this writing is still an adolescent medium, as technologies in an “alpha revision” state rely on design fictions and crowd-sourced bootstrapping to will them into being. This decade-later extrapolation of my idea of “alpha revisionism” has culture in a state where science fiction begins to pale in light of propositional videos and developer kits for *Star Trek*-like devices. In conclusion, I hope that I have made points for further discussion, created a discursive framework for the genre, and set up propositional qualia for the study of augmented reality. As with all writing on technology, much of this will serve as a record and date itself, but I hope that some of the principles herein will remain.

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