Dots and Dashes: Art, Virtual Reality, and the Telegraph

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ABSTRACT

Dots and Dashes is a virtual reality artwork that explores online romance over the telegraph, based on Ella Cheever Thayer's novel *Wired Love - a Romance in Dots and Dashes (an Old Story Told in a New Way)[1]*. The uncanny similarities between this story and the world of today's virtual environments provides the springboard for an exploration of a wealth of anxieties and dreams, including the construction of identities in an electronically mediated environment, the shifting boundaries between the natural and machine worlds, and the spiritual dimensions of science and technology. In this paper we examine the parallels between the telegraph networks and our current conceptions of cyberspace, as well as unique social and cultural impacts specific to the telegraph. These include the new opportunities and roles available to women in the telegraph industry and the connection between the telegraph and the Spiritualist movement. We discuss the development of the artwork, its structure and aesthetics, and the technical development of the work.

Keywords: Virtual reality, telegraph, art, spiritualism, new media, art and technology

1. INTRODUCTION

Fig.1. Screenshot from *Dots and Dashes.*

1.1 Dots and Dashes

Dots and Dashes is a virtual reality artwork that explores the idea of telegraphy as the first "cyberspace". Over a hundred years before the Internet, the telegraph networks connected distant places around the globe. The data that flowed across these networks included everything from real-time stock market information, sports scores and news headlines to personal correspondence, chess games, and online romance. In *The Victorian Internet,* Tom Standage outlines the many parallels between the telegraph and the Internet, particularly the utopian visions and the accompanying dangers ascribed to both technologies[2]. Our interest, however, is not just in the telegraph as a communication device, but also more specifically in the experience of the user within the telegraph network and the new conceptions of embodiment, presence, and space that it produced.

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1.2 Artists and new media

As media artists, we live immersed in the rhetoric of newness, capriciously balanced between utopic and dystopic futures. Like the rapid obsolescence built into our electronic devices, new media art is often seen as existing in a constant state of ahistorical reinvention. Whether fairly or unfairly, virtual reality is a medium which has been particularly emblematic of this issue. The work of media archaeologists, historians, and theorists such as Oliver Grau, Erkki Huhtamo, N. Katherine Hayles, and Mark Hansen has brought new understanding to the historical trajectories of both media technologies and media art, opening the way to a more nuanced analysis of electronic art as both distinct and connected to the world of contemporary art. As artists working with virtual reality, we explore these connections and histories within the work itself.

The impetus for *Dots and Dashes* was a fortuitous encounter with the story *Wired Love,* a Victorian tale of love found on the telegraph. The story instantly brought us back to the early days of our own relationship, in which we spent months communicating only by email and VAX Chat. Today, like many academic couples, we find ourselves with jobs in cities hundreds of miles apart, with a relationship heavily negotiated via cellpone, SMS, email, and Skype. This project began as a way to understand our own specific relationship as influenced by electronically mediated forms of communication.

Three primary issues orient our current research – an interest in forgotten things, obsolescence, and the parts left out of official histories; the importance of the telegraph or other technologies for women in a patriarchal society; and the strange and fantastic mix of science and spiritualism that surrounds both the telegraph and virtual reality. In this paper we begin with a discussion of these ideas and their relevance to contemporary new media. This research provides the background and inspiration for our artwork in virtual reality.

2. TELEGRAPH HISTORY

If we could rise above the surface of the earth, and take in the whole country at a bird's-eye view, with visual power to discern all the details, the net-work of the telegraph would be still more curious to look upon. We should see a web spun of two hundred thousand miles of wire spread over the face of the country like a cobweb on the grass, its threads connecting every important centre of population, festooning every great post-road, and marking as with a silver lining the black track of every railroad. ... The whole net-work of wires, and the submarine cables which connect it with other equally active systems on the other side of the globe, are all quivering from end to end with signals of human intelligence.[3]

This history of the telegraph, published in Harper's new monthly magazine in 1873 goes on to describe the telegraph as both a web and a labyrinth, in which "every phase of the mental activity of the country is more or less represented." As the first electronic communication network, the telegraph was the beginning of a technological progression leading to today's Internet and mobile phone networks. A brief overview of this progression might include the telephone, radio, television, fax, videoconferencing, the Internet, the Web, the cellphone, SMS, and now the mobile and pervasive net. A small extension from our actual to our imagined technologies adds virtual reality to the end of the progression. In the grand narrative view of history, this is a story of progress in two ways. Technological progress drives a steady increase in the bandwidth, speed, and reach of the networks. Furthermore, the sensory channels of communication increase, from specialized code to text, then to sound, moving image, and then to the pervasive or immersive image. This technological progress is seen as driving social progress, improving economic growth, spreading political and intellectual freedom, and generally contributing to the greater good. In this history, past technologies quickly become irrelevant. NPR's Robert Segel, reporting on Western Union's last telegram in 2006, remarked that the only thing that had kept the telegram out of the "dustbin of history" for so long was the "glacial tediousness of extinction itself."[4] The term "extinction" fits into Ray Kurzweil's schema of technological development as a form of deterministic evolution, in which the survival of the fittest technologies leads towards perfection[5]. The implication of this view is that the telegraph has little contemporary relevance. But technologies don't evolve independently; they are always situated in specific historical and cultural contexts. The telegraph gives us a way of examining our own networked culture and its collisions between the possible and the actual, but it also contains its own unique characteristics and possibilities.

3. LIFE ON THE WIRE

Our interest in the telegraph is not in its use by institutions of power and capital, but rather in the ways in which users extended the network beyond its intended use. The telegraph was primarily used for business communication, a deliberate emphasis on the part of the telegraph companies. The idea of personal communication over the telegraph seemed unimportant, at least to the companies who controlled the wires. While some critics called for greater access, the telegraph companies insisted that the average citizen had no use for the telegraph[6]. Monopolies and high rates kept the telegraph primarily in the domain of business, finance, government, and the wealthier classes for the majority of its history. This debate mirrors contemporary issues of the digital divide and network neutrality, and is instructive as a case in which the monopolies essentially win out over public demands for greater access to the network.

Due to its business origins, the telegraph did not become as enmeshed in daily life as its inventors had hoped, and as later communication technologies would prove to be. It did, however, have a profound impact on the lives of the telegraph operators. Rapid translation and transmission of messages in Morse code required skilled operators, and created a profession unique to the telegraph. Unlike the telephone or email, those sending and receiving telegraphs had no actual contact with the equipment. The operators, however, were "on the wire" for hours every day. In between the official business of sending and receiving telegrams, the operators were able to use the wires freely, developing what were essentially the first online communities, with elite-speak, code names, friendships, and online romances.[7]

While the telegraph did connect people in general, for the operators the connection was instantaneous and continuous. Operators described a sense of place that developed online, the sensation of being present simultaneously in physical space and another, unseen space.[8] This sense of presence, and its accompanying disembodiment, form the core of the notion of cyberspace in any of its forms. At the same time, the telegraph was a uniquely tactile medium, operating by touch and by sound. Email or Internet chats transmit only the text in the abstract, but the "quivering" sensitivity of the telegraph network also contains the nuances of touch. For the expert operator, the sound of Morse code is like a natural language, and the key becomes an extension of the physical body.[9] Using N. Katherine Hayles' formulation of the human enmeshed with information, the telegraph operators could also be called the first cyborgs[10].

All of this was taking place invisibly – on the wire, and also under the radar. In the industrial logic of the nineteenth century, the telegraph operator's official status was just as another part of the communication machine, not as an individual subject. The most revolutionary effects of the technology were unintended, not sanctioned, and in many ways unrecognized for decades until they re-emerged with the spread of computer networks in the late twentieth century. Just as telegraph operators developed their own online communities in the space between official transmissions, the early users of what would become the Internet developed email, chat, online gaming, and other fundamental aspects of today's networked culture for their own use outside the official purpose of the network.

4. WOMEN AND THE TELEGRAPH

As the telegraph networks spread, female operators became an increasingly large segment of the workforce. At a time when women had few employment possibilities, this newly-created occupation was unique. In addition to better working conditions, the occupation also required a higher level of skill and offered a greater degree of public social interaction than other alternatives. In 1875, *The Telegrapher* described the work as "in short, 'a nice occupation', and better than standing in stores and working in mills." While the telegraph companies, particularly Western Union, actively recruited women, the profession was seen as gender-neutral until the shift to teletype systems around 1915.[11]

It's difficult to find an exact analogue to the telegraph operator in today's spectrum of information technology careers. The required skill in rapid encoding, decoding, and interpretation of information would certainly put it above basic data entry; some historians compare it to computer programming.[12] The closest analogy might be HTML web page coding, if one had had to write web pages all in binary machine language and in real time. Unlike jobs like stenography or secretarial work, the telegraph operator was a gender-neutral occupation, and one of the few in which women and men held the same positions. Since skill and speed were the only things that determined one's ability as an operator, female operators were suddenly in a position of equality with their male colleagues. Differences in physical strength no longer mattered, as they did in industrial or agricultural work. In other spheres, inequality was maintained through Victorian gender roles.[13] The telegraph, however, interfered with these restrictions by giving operators a new, almost anonymous

identity, identified only by initials and code letters. Without a visible body, voice, or even a name, it was far more difficult to immediately identify the sex of other operators on the wire. This afforded women a new kind of agency and voice in addition to economic independence. On the wire, this came from the new kind of bodiless identity. As Jeffrey Sconce puts it, "For many women of the period, telegraphic presence was an important electrical space that disassociated the gendered body from the patriarchal realm of thoughts and ideas, thereby making possible new forms of political expression."[14] Jepsen comes to similar conclusion: "Cyberspace can be seen as a nongendered space in which all voices are disembodied; telegraphers, the original inhabitants of cyberspace, were the first to experience its gender-neutral qualities." This may be overstating the case for cyberspaces in general. If "cyberspace is where you are when you're talking on the telephone," a description variously attributed to John Perry Barlow or William Gibson, then that form of cyberspace is a heavily gendered one. The cyberspaces that have emerged from the Internet may contain the possibility of gender neutrality, but they are just as frequently re-inscribed with gender and other codes, even if those codes are mixed or subverted. The telegraph is unusual in that its technical design virtually enforces this gender neutrality.

In relation to the public, both male and female operators acquired some of the aura of the telegraph technology itself. For women, the performance of encoding and decoding provided a new authoritative voice as the interpreter of information incomprehensible to the layman. This new voice was soon reflected and amplified in the form of Spiritualist mediums, who extended the enigmatic abilities of the telegraph to include the realm of the dead.

5. THE SPIRITUAL TELEGRAPH

5.1 The telegraph and the occult

There are numerous parallels between the use of the telegraph and the use of the Internet. But technologies have additional impact beyond their immediate practicality, a larger life in the public imagination that shapes our dreams and anxieties. The telegraph introduced not only a means for transmitting information from place to place, but "the idea of a utopian electronic space," through "a new way of conceptualizing communications and consciousness."[15] During this time, media technologies (the telegraph, photograph, telephone, and phonograph) occupied a unique dual position. These media were the product of rational scientific discovery, triumphs of individual genius and mental ability. At the same time, they acquired an aura of magic, often centered on the power of electricity as a kind of invisible life force. The telegraph became a key part of the "Modern Spiritualism" movement, which framed table tapping and other séance techniques as a kind of "spiritual telegraph" able to communicate with other realms.

5.2 The Spiritualist movement

Spiritualism was a widespread movement combining religion, science, and progressive politics, whose members included influential figures of the time such as Harriet Beecher Stowe and Abraham Lincoln. In *Radical Spirits*, Ann Braude describes Spiritualism as providing "scientific evidence of religious truth [for] those no longer convinced by the 'evidences' of Christianity."[16] In addition to their commitment to women's rights, Spiritualists "led so-called "ultraist" wings of the movements for the abolition of slavery, for the reform of marriage, for children's rights, and for religious freedom, and they actively supported socialism, labor reform, vegetarianism, dress reform, health reform, temperance, and antisabbatarianism, to name a few of their favorite causes."[17] In this combination of radical political positions, social experimentation, and adoption of new media technologies, the Modern Spiritualists were a precursor to the cyber counter-culture of the 1990's embodied by *Mondo 2000*.

5.3 Women and Spiritualism

While some mediums were male, most were female, and most Spiritualists tended to place greater trust in female mediums. This gave women a new kind of public voice and authority. There was a widespread belief that women were more attuned to invisible forces, and therefore better able to transmit and interpret messages from the spirit world. During the same time period, Jean-Martin Charcot's experiments in hypnosis and hysteria were being used as scientific evidence of the neurological weakness of women. Among Spiritualists, however, the same physical manifestations were part of the scientific evidence of female affinity for mediumship.[18] Science was used to deny the female voice, on the one hand, and on the other to affirm it as a source of spiritual and political authority.

5.4 Spiritualism and Gibson's cyberspace

It is tempting to view the spiritual telegraph simply as an artifact of an earlier age, a superstition brought about by an encounter with the unknown by people still in the process of the transition to modernity. As Jeffrey Sconce points out, however, the idea of our media as "haunted" has remained with us ever since, and is particularly strong in our conceptions of virtual reality. Consider William Gibson's *Neuromancer*, the defining image of cyberspace - it is a story of global capitalism and technology, but also one of electronic spirits, the disembodied self, and communication with the dead. Molly and Case, aided by a construct of the dead hacker Dixie Cowboy, free the AI's Wintermute and Neuromancer, who achieve sentience within the Matrix. In *Count Zero* and *Mona Lisa Overdrive*, these AI's generate a host of *loa*, the powerful spirits of the Voudoun religion. Through biotechnology, they are eventually able to possess human hosts, like a spiritualist medium giving voice to the dead through the telegraph.

6. *WIRED LOVE*

6.1 Romance, Online Personas, Love and Deception

Wired Love: A Romance in Dots and Dashes is a romance novel, containing secret longings, jealousies and mistaken identities, as well as what Katherine Stubbs calls "the most extensive nineteenth-century meditation on the ways communication technology can be used to negotiate embodiment."[19] The novel follows the story of Nattie, a young telegraph operator, and her romance with a fellow operator known at first only as "C". Nattie is nineteen, lives in a boarding house under the baleful eye of her spinster landlady, and dreams of becoming a writer.

> Miss Nattie Rogers, telegraph operator, lived, as it were, in two worlds. The one her office, dingy and curtailed as to proportions, but from whence she could wander away through the medium of that slender telegraph wire, on a sort of electric wings, to distant cities and towns; where, although alone all day, she did not lack social intercourse, and where she could amuse herself if she chose, by listening to and speculating upon the many messages of joy or of sorrow, of business and of pleasure, constantly going over the wire. But the other world in which Miss Rogers lived was very different; the world bounded by the four walls of a back room at Miss Betsey Kling's. [20]

In between messages, she meets "C.", an operator further down the line at the tiny junction of "X-n". At first they engage in friendly competitions of telegraphic skill, and soon are trying to learn more about each other.

> "Can you not, however, leave the beauty out, and give me some sort of an idea about yourself for my imagination to work upon?"
> "Certainly!" replied Nattie, with a mischievous twinkle in her eye that "C" knew not of. "Imagine, if you please, a tall young man, with--"
>
> "C" "broke" quickly, saying, "Oh, no! You cannot deceive me in that way! Under protest I accept the height, but spurn the sex!"
>
> "People who think they know so much are often deceived; now I make no surmises about you, but ask, fairly and squarely, shall I call you Mr., Miss, or Mrs. 'C'?"
>
> "Call me neither. Call me plain 'C', or picture, if you like, in place of your sounder, a blonde, fairy-like girl talking to you, with pensive cheeks and sunny--" [21]

Over time they develop a close friendship in between official telegrams and interruptions from other operators on the circuit. One day, C. announces that he'll be away from his station, covering another post. He suddenly shows up at Nattie's office, and she is horrified to discover that in person he is nothing like the man she thought he was:

> ... she thought of Quimby's warning about the "soiled invisible," and barely suppressed a groan. Involuntarily she stole a glance at this too-visible person, and shuddered. Could she reconcile "C," her visionary, interesting, witty and gentlemanly "C" of the wire, with this musk-scented being of greasy red hair, cheap jewelry and vulgar manners? Impossible! [22]

His online persona appears to be a fraud. Nattie is heartbroken, and swears off love forever. Soon afterwards a stranger comes to dinner as a guest of Quimby, another resident of the apartment house. After hearing Nattie's story, he reveals himself as the true C. by tapping Morse code to her with a pencil.

> Suddenly Nattie was disturbed by Mr. Stanwood drumming with a pencil on the marble top of the table, and glancing up casually, observed his eyes fixed upon her with a peculiar expression, and at the same moment her ear seemed to catch a familiar sound. With a slight start she listened more attentively to his seemingly idle drumming. Yes--whether knowingly, or by accident, he certainly was making dots and dashes, and what is more, was making N's![23]

It turns out that the man who appeared at her office was an impostor, another operator on the same circuit:

> "Well--yes," replied the pencil with provoking slowness. "Don't you '_C_' the point? Can't you 'C' that you did not 'C' the 'C' you thought you did 'C' that day?"

Nattie and Clem (Stanwood, aka C.) are reunited, and he decides to move in with his friend Quimby. Propriety and the ever-present Miss Kling still keep the two apart, even in the same house. The situation is further complicated by a tangled web of misplaced affections between all the residents of the apartment house, including Nattie, Clem, the infinitely clumsy Quimby, the outgoing young opera singer Cyn, their upstairs neighbor Celeste Fishblate, and the Bohemian yet strangely anti-romantic artist Jo Norton. Though they live down the hall from each other, Nattie and Clem have lost the ease and freedom of their online relationship, and are only able to regain it by talking to each other through Morse code. This leads them to string a hidden telegraph wire between their apartments, which they use for intimate conversations early in the morning and late at night. Eventually Miss Kling discovers their apparatus, and, scandalized, threatens to evict Nattie; but at the critical moment, Clem grabs the telegraph key and proposes to Nattie in Morse code, defeating the prudish landlady and scoring victory for wired love.

6.2 Communication fictions

One of the central themes of *Wired Love* is the idea that mediation can provide forms of honest, direct connection which otherwise would be prevented. A comparable fictionalization for the Internet can be found in the 1998 film *You've Got Mail,* in which the protagonists find connection through anonymous email while being bitter enemies in real life. The film's inspiration, *The Shop Around the Corner* (1940)*,* uses anonymous pen pal letters in the same way. But an additional theme of *Wired Love* is the transgressive use of the technology. Nattie's flirtation and friendship with Clem and their private telegraph line are violations of the strict morality of the Victorian era. Their conversations are also a misuse of the network, taking place when they ought to be transmitting messages for paying customers. This theme reappears in the 1986 film *Jumping Jack Flash*, where Terri Doolittle (Whoopi Goldberg), a computer operator at a bank, conducts a clandestine relationship over her data terminal with a man claiming to be a spy. *Jumping Jack Flash* is set before the advent of the Internet, featuring a computer network which is the private, and very expensive, property of the bank. Terri's transgressive use of the network is presented as part of her individualistic personality, pushing for human connections in the face of technocratic institutionalization. In the case of Nattie, her relationship on the wire is illicit both for the personal use of the technology and for the very fact of the relationship itself.

7.   *DOTS AND DASHES* - CONCEPT AND STRUCTURE

Fig. 2. Screenshot from *Dots and Dashes.*

7.1 Narrative and structure

Dots and Dashes does not use the full narrative of *Wired Love*, but rather uses the novel as a framework for explorations around its core ideas and the relationship of the telegraph to virtual reality. Given the narrative structure as a starting point, our first decision was whether to position the user primarily as an actor or participant within the story, or as a viewer or reader external to it. The plot is largely advanced through dialog, making it difficult to adapt to an interactor structure without adding a text-based input device and some form of dramatic engine. We instead decided to present the story in a primarily visual manner, using a series of interconnected vignettes and navigational pathways between them.

Our fundamental interest is in the experience of disembodiment and telematic presence produced by the telegraph, so we have structured the piece around a combination of physical spaces (the telegraph office, the rooms in the boarding house), and virtual spaces (the imagined space of the telegraph network). The elements of the story are presented as visual and textual fragments, which the viewer encounters by navigating through the house and over the wires. Additional scenes and characters include a spiritual telegraph séance, Edison's talking doll, Charcot's experiments with hysterics, an illusionist, and a proto-version of the CAVE made from magic lanterns.

7.2 Navigation and Camera System

Since the primary interaction is through navigation, we use different camera motion paradigms to accentuate the experience of different scenes. VR artworks tend to assume a completely free-moving first-person point of view, as the primary feature that distinguishes VR from other media. In cinema, control of the camera is one of the fundamental aesthetic tools, one which is lost in VR. However, we can use styles of freely-controlled camera motion to similar effect. Interior scenes are presented in a cutaway architectural view, using a camera with a fixed range of translation and zoom. This evokes a sense that the scene is a miniature or a construction, and keeps the viewer in position with a certain degree of distance. The telegraph space uses a flying type of navigation, while other scenes use an orbital view with a fixed point of interest.

7.3 Interactions and the role of the viewer

To connect the different vignettes, we use a structure inspired by the CD-ROM *Ceremony of Innocence*, an interactive adaptation of Nick Bantok's *Griffin and Sabine* books. *Ceremony of Innocence* is essentially a linear narrative, but it engages the viewer through visual puzzles and interactions in between sections of the text. Each chapter is in essence a small machine; when the viewer figures out how to activate it, it comes to life, and the story continues. *Dots and Dashes* uses a similar strategy, presenting the viewer with interactions in each vignette that activate and continue the story. These actions include operating a telegraph key, grabbing hold of fragments of Morse code to translate them into text, animating mechanical toys and paper cutouts, connecting wires, opening doors and moving furniture. The viewer becomes a participant as an invisible force, like the invisible animating force of electricity.

7.4 Typology

Describing and categorizing interactive works in a meaningful way is notoriously difficult. *Dots and Dashes* contains elements of traditional linear fiction, generative text, cinematic narrative, hypertext, and the adventure game. Using Espen Aarseth's typology schema[24], we can describe the work as a combination of variables.

1. Dynamics: while the scenes and many of the animations are pre-designed, or static, their behavior is largely dynamic.
2. Determinability: the paths between primary scriptons (scenes and environments) are largely determinate, but each contains indeterminacy.
3. Transiency: the text is transient; events can occur and progress without actions by the user.
4. Perspective: the user's perspective is impersonal, as a reader outside the story, rather than personal, as a character inside the story.
5. Access: the access between scenes (textons) is controlled; links between sections are only available along specific paths.
6. Linking: explicit and conditional; links become available only after other actions.
7. User Functions: the user's actions are primarily explorative and configurative – navigating and exploring the space, and configuring or manipulating elements within it.
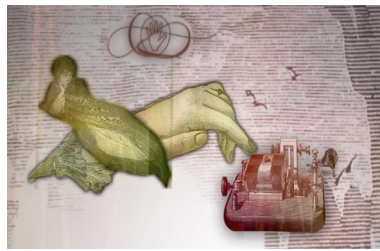
8. AESTHETIC STRATEGIES

Fig. 3. Screenshot from *Dots and Dashes*

8.1 Influences

When designing the look for *Dots and Dashes*, we wanted to find an aesthetic that would speak to the richness and strangeness of a telegraphic cyberspace. We were immediately drawn to Max Ernst's collage books, *Une Semaine de Bonté* and *A Little Girl Dreams of Taking the Veil*. The woodcut look, dreamlike scenarios, and irrational, fragmented narrative fit perfectly with the project. Using Joseph Cornell's boxes as a model, we also began to think of the scenes as both immersive spaces and as miniature assemblages. The stop-motion animations of The Brothers Quay suggested ways that these ideas could be translated into time-based forms, particularly through the highly mechanized character of the camera movement and extensive use of tight depth of field. Finally, when designing the characters, we were drawn to the woodcarvings of the American folk-art sculptor Asa Ames.

8.2 Constructions of space

The resulting aesthetic evokes the era of the telegraph as a multilayered space, both physical and virtual. A frequent expectation in VR is photorealism, increasing approximation of the real world approaching the point where the two are indistinguishable. This expectation is sometimes explicit, sometimes implicit. This is an important goal in simulator applications, but art allows and requires a wider range of visual possibilities. Combining 2D images with 3D objects and spaces creates an environment in transition between 2D and 3D. This hybrid space references the popularization of the stereoscope in the 1840's, which created this new technological form of vision at precisely the same historical moment as the telegraph. Within this space, we move between three scales: massive scale, in the telegraph network; human scale, in the constrained domestic space which is the primary setting for the story; and miniature scale, the scale of dollhouses, dioramas, models, and mechanical toys.

8.3 Immersion and artificiality

Another common expectation in VR is the production of a seamless sense of immersion, in which the viewer is entirely engulfed in the image. While we do aim to create a visually rich and engaging experience, we also highlight rather than disguise the artificiality of the VR environment through the visual look, deliberately mechanical animation, and camera control. This strategy is intended to balance the seductive immersion of the VR environment, addressing the problem of "critical distance" which Oliver Grau identifies as one of the core issues in virtual art.[25]

9. TECHNICAL IMPLEMENTATION

9.1 Implementation

While authoring systems for VR artworks have improved greatly, most projects still require some level of customization. The initial implementation of *Dots and Dashes* used Ygdrasil[26], a high-level scripting language based on OpenGL Performer and the CAVE library. There were several additional features needed for the project:

- Animation. The piece relies heavily on animated characters and objects, which required the ability to animate using a package such as Maya. Ygdrasil included only the capacity for code-based animation and geometry flipbooks.
- Text. One of the oddities of the underlying OpenGL Performer library is its peculiar font format requirements for displaying text in the scenegraph, which in practice severely limits the number and usability of available fonts.
- Lightmaps. Lighting is a crucial element of the design; even including static shadows can make a significant contribution to the depth and mood of the environment.
- Shaders. In order to integrate the 2D woodcut collage elements and 3D models, we wanted to simulate the woodcut look when rendering select models and environments. This required the addition of vertex and fragment shader capability to Ygdrasil.

For text, we created a "customText" node which can use any 3D model as a font, using the internal node names to identify glyphs. This meant we could easily create custom fonts in Maya. We implemented the additional features primarily through the creation of a new file format to transfer model data from Maya to OpenGL Performer[27]. The format maintains the scene hierarchy and naming of nodes from Maya, which can then be animated using animation curves exported from Maya. It also supports multitexturing, including the automatic use of Mental Ray lightmaps. We added animation capabilities through a new "mayaAnimation" node in Ygdrasil, which supports switching between multiple animation clips on the same model as well as animation retiming. Finally, we added support for GLSL shaders, and a shader based on the hatching shader by Bert Freudenberg. [28]

9.2 Future Work

Since OpenGL Performer has been discontinued, we are now investigating alternative platforms for *Dots and Dashes*. Our current version is now built with Panda3D[29], which offers more advanced scripting flexibility and animation support. This process of translation highlights the issues with archiving and preservation facing artists working in VR. Changing platforms, software, and hardware pose problems for all forms of computer based art, but are particularly problematic when the technologies are highly specialized, arcane, and/or costly, as in many VR works. We consider *Dots and Dashes* to be an ongoing project, with further developments in VR as well as online components and physical objects. It will therefore serve as a useful test case for examining strategies for maintaining, upgrading, and porting virtual artworks on continuously changing platforms.

10. CONCLUSION

Creating art with new technologies is a search for new aesthetic possibilities, but also a form of critical engagement with the broader implications of those technologies. Connecting our new media with their hidden and forgotten histories allows us to use the past to gain new perspective on the present, and helps us address the deep currents and motivations that run throughout the history of human engagement with electronic information. By linking the telegraph and virtual reality, we tie together the origin and the current endpoint of this progression. In rediscovering obsolete technologies, we also emphasize the unique possibilities and alternatives they offer within a specific historical and social context. This is an ongoing and expanding field of scholarship, which will grow in importance with new media's accelerating cycles of invention and obsolescence. In *Dots and Dashes* we pursue this research through artwork in virtual reality, combining a forgotten technology with an artistic medium still in the process of being discovered.

REFERENCES

[1]   Thayer, Ella C., [Wired Love – A Romance in Dots and Dashes (an Old Story Told in a New Way)], W.J. Johnston, New York, (1880).

[2]   Standage, Tom, [The Victorian Internet], Walker, New York, (1998).

[3]   "The Telegraph," Harper's New Monthly Magazine, 47 (279), 332-333 (August 1873).

[4]   Siegel, Robert, "Western Union Sends Its Last Telegram," All Things Considered, (February 2, 2002).

[5]   Kurzweil, Ray, [The Age of Spiritual Machines: When Computers Exceed Human Intelligence], Penguin Books, New York, (1999).

[6]   Wolff, Joshua D., "The 'Great Monopoly': Western Union and the American Telegraph, 1845-1893", unpublished dissertation, Columbia University, 12 (2008).

[7]   For a first-hand account, see Hall, L.C., "Telegraph Talk and Talkers, Character and Emotions: An Old Telegrapher Reads On the Wire", McClure's Magazine, 227-231 (January 1902).

[8]   Sconce, Jeffrey, [Haunted Media: Electronic Presence from Telegraphy to Television], Duke University Press, Durham & London, 21-22 (2000).

[9]   Jay Clayton discusses the importance of the telegraph's tactile and auditory nature and the operator's position in the network in chapter 2 of [Charles Dickens in Cyberspace: the afterlife of the nineteenth century in postmodern culture], Oxford University Press, New York, (2003).

[10]   Hayles, N. Katherine, [How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics], University of Chicago Press, Chicago, (1999).

[11]   Jepsen, Thomas C., [My Sisters Telegraphic], Ohio University Press, Athens, Ohio, (2000).

[12]   Jepsen, 195.

[13]   For a discussion of gender roles and Victorian technologies, see Marvin, Carolyn, [When Old Technologies Were New], Oxford University Press, New York, (1988).

[14]   Sconce, 14.

[15]   Sconce, 7-9.

[16]   Braude, Ann, [Radical Spirits: Spiritualism and Women's Rights in Nineteenth-century America], Indiana University Press, Bloomington, IN, 4 (2001).

[17]   Ibid.

[18]   Ibid.

[19]   Stubbs, Katherine, "Telegraphy's Corporeal Fictions," in [New Media: 1740-1915], Gitelman, Lisa and Pingree, Geoffrey B., Eds., MIT Press, Cambridge, 99 (2003).

[20]   Thayer, 25.

[21]   Thayer, 22.

[22]   Thayer, 97.

[23]   Thayer, 148.

[24]   Aarseth, Espen J., [Cybertext: Perspectives on Ergodic Literature], Johns Hopkins University Press, Baltimore, Chapter 3 (1997).

[25]   Grau, Oliver, [Virtual Art: From Illusion to Immersion], MIT Press, Cambridge, 204-206 (2003).

[26]   Pape, D., Anstey, J., Dolinsky, M., and Dambik, E. J., "Ygdrasil: a framework for composing shared virtual worlds," Future Gener. Comput. Syst. 19, 1041-1049 (2003).

[27]   Source code for the B3D file exporter and new Ygdrasil nodes is available at http://www.bcchang.com/research/vr

[28]   Freudenberg, Bert, In Randi Rost, [OpenGL Shading Language], Addison Wesley Professional, Upper Saddle River, NJ, 356-364 (2004).

[29]   Goslin, Mike and Mine, Mark R., "The Panda3D Graphics Engine," Computer, 37, 112-114 (2004).