Electronic Superhighway: Nam June Paik and the Infrastructure of Circulation

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NAM JUNE PAIK ART CENTER
백 남 준 아 트 센 터

Electronic Superhighway: Nam June Paik and the Infrastructure of Circulation — Maeve Connolly

1 Lauren Cornell and Ed
   Halter, "Hard Reboot:
   An Introduction to *Mass
   Effect*", *Mass Effect: Art
   and the Internet in the
   Twenty-First Century*,
   ed. Lauren Cornell and
   Ed Halter, (Cambridge,
   Mass. and London: The
   MIT Press, 2015), xv.

2 Seth Price, "Dispersion",
   in *Mass Effect: Art
   and the Internet in the
   Twenty-First Century*,
   ed. Lauren Cornell and
   Ed Halter, (Cambridge,
   Mass. and London: The
   MIT Press, 2015), 51-
   69. This text originated
   in 2002 and is available
   as a PDF via the artists
   own website: www.
   distributedhistory.com
   Accessed October 19,
   2016.

3 Infrastructures often
   only acquire visibility
   in moment of crisis
   or failure, as noted
   by Paul N. Edwards,
   "Infrastructure and
   Modernity: Force, Time,
   and Social Organization
   in the History of
   Sociotechnical Systems"
   in *Modernity and
   Technology*, ed. Thomas
   J. Misa, Philip Brey,
   and Andrew Feenberg
   (Cambridge Mass.: The
   MIT Press, 2003), 185.

Introduction

This paper forms part of a larger research project, which examines how artists have engaged with changing infrastructures and technologies of transport and circulation since the 1950s. My research seeks to frame and interrogate the artist as agent, analyst and (in some instances) advocate of infrastructural and technological change, tracing the development of an infrastructural imaginary within art practice over several decades. Although the scope of my research extends from the 1950s to the present moment, I am primarily concerned with developments in art practice and media infrastructures after 2002, following the generational differentiation proposed by Lauren Cornell and Ed Halter in *Mass Effect: Art and the Internet in the Twenty-First Century*.

Observing that artistic practices associated with "the first generation of net.art [···] have been extensively historicized', Cornell and Halter identify a new artistic relation to the internet, following its emergence as a dominant cultural form and mass medium:

> Broadly speaking, this subsequent [post-2002] generation respond to the internet not as a new medium, but rather as a true *mass medium*, with a deeper and wider cultural reach, greater opportunities for distribution and collaboration, and advanced corporate and political complexities.[1]

Cornell and Halter's edited anthology features contributions from various artists, including Cory Arcangel, Paul Chan, Aleksandra Domanovic, Oliver Laric, Mark Leckey, Trevor Paglen, Seth Price, Hito Steyerl and Martine Syms. In addition to producing artworks, these artists have engaged with the internet as researchers and writers, often producing texts or other publications. Some of these artists have also adapted or coined specific terms (such as Price's 'dispersion'[2]) to articulate transformations in the capacities, operations or properties of the internet and related media infrastructures. Through these acts of naming, they increase the tangibility and visibility of media infrastructures, which might otherwise remain obscure or overlooked.[3]

In this paper, I consider a much earlier act of naming, which occurred before the emergence of the internet as mass medium. Focusing on the work of Nam June Paik, I examine how the image and metaphor of the 'electronic superhighway' – emphasizing parallels between and systems of road transport and telecommunications – was deployed by Paik (and others) in the late 1960s and early 1970s to articulate and contextualize new and emerging infrastructures of telecommunication and circulation. I also discuss the return of the concept of the 'electronic superhighway' as the title of a major exhibition at the Whitechapel Gallery in London, exploring artists' responses to technology over five decades. "Electronic Superhighway (2016-1966)", which ran from 29 January to 5 May 2016, was curated by Omar Kholeif, with Emily Butler and Seamus McCormack, and developed with input from a Curatorial Advisory Committee consisting of Erika Balsom, Heather Corcoran, Ed Halter and Sarah Perks. The exhibition included two major works drawn from different moments in Paik's practice; a video documenting the 1984 satellite broadcast *Good Morning Mr. Orwell* and *Internet Dream*, a large-scale multi-monitor work from 1994, originally commissioned for the Cologne headquarters of German broadcaster RTL. The inclusion of these two works underscores Paik's unparalleled contribution to dialogues between art and technology over several decades. But in this paper I am primarily interested in the electronic superhighway concept, exploring its relevance to telecommunications policy

4   This report was written in 1974 but first published two years later in German translation, in *Nam June Paik. Werke 1946–1976. Musik – Fluxus – Video,* (Cologne: Kölnischer Kunstverein, 1976.) English language excerpts from the report were published in *The Electronic Superhighway,* ed Nam June Paik and Kenworth W. Moffett, (New York, Seoul, and Fort Lauderdale: Holly Solomon Gallery, Hyundai Gallery, and the Fort Lauderdale Museum of Art, 1995), 39-47 and also published online at *Medien Kunst Netz.* http://www.medienkunstnetz.de/source-text/33/ [accessed 20 October 2016]

5   William Kaizen, "Computer Participator: Situating Nam June Paik's Work in Computing", in *Mainframe Experimentalism: Early Computing and the Foundations of the Digital Arts,* ed. Hannah B. Higgins and Douglas Kahn (Berkeley: University of California Press, 2012), 229.

6   Kaizen, 236.

7   Kaizen also references Paik's 1968 report *Expanded Education for the Paperless Society,* also funded by the Rockefeller Foundation, framing it as "a prescient discussion of key concerns related to computing and the database as a cultural archive", 235.

8   Kaizen, "Computer Participator," 233.

9   Thomas Streeter, "Blue Skies and Strange Bedfellows: The Discourse of Cable Television," in *The Revolution wasn't Televised: Sixties Television and Social Conflict,* ed. Lynn Spigel and Michael Curtin (New York and London: Routledge, 1997), 222.

rhetoric and contemporary artworks engaging with the internet as mass medium.

Media Planning, "Blue Skies" and Telecommunications Policy

Paik first used the phrase "electronic super highway" in a report titled *Media Planning for the Postindustrial Society – The 21st Century is Now Only 26 Years Away,* commissioned in 1974 by the Art Program of the Rockefeller Foundation.[4] In this report, Paik envisaged a "broadband communication network" created through the expansion and integration of existing technologies, including videophones, fax machines and two-way television. This network, the report states, will enable a whole range of functions and services, including "shopping, bibliographies, opinion polls, health care, bio-communication [and] data transfer from office to office." William Kaizen describes the *Media Planning* report as both utopian and prescient, noting that Paik "clearly predicts the future of personal multimedia computers connected by online access."[5] Kaizen frames the report as "a position paper on why the government and philanthropists should support public development of the information superhighway rather than allow this work to be done by corporations."[6]

The *Media Planning* report was just one of several communications research texts produced by Paik[7] during the late 1960s and 1970s, following his experience of working experimentally with computers at Bell Labs in the mid-1960s. According to Kaizen, Paik's practical experiments with computing tended to focus on relatively abstract properties and capacities of this technology, such as randomness and iteration. But Paik also sought to communicate the potential of computing and telecommunications as a means of increasing citizen participation through his writings, which Kaizen describes as "far more populist"[8] in their engagement with computing. Paik's interest in electronic mass media, as a potential means of two-way communication, was also shared by many other "60s media radicals" including (as Kaizen notes) Ralph Lee Smith, a contributor to *Radical Software* magazine and the author of the 1972 book, *The Wired Nation: Cable TV: The Electronic Communications Highway.*

During the late 1960s, cable television featured very prominently in US political debates about participation. This era was marked by civil unrest and significant changes in broadcasting and communications policy, eventually leading to the establishment of PBS, and new requirements for locally-originated programming on Community Antennae cable television (CATV). In a persuasive analysis of the "blue skies" discourse that helped to shape these changes, Thomas Streeter identifies the emergence of an "odd alliance" in support of cable technology, including "1960s media activists, traditional liberal groups, industry lobbyists and Republican technocrats".[9] Cable was not actually a new technology, having evolved since the 1940s as a service to address local and regional deficiencies in network coverage. But, as a minor player within the broadcasting sector as a whole, the cable industry used the newly-increased carrying capacity of coaxial cable to lobby for improved contracts and conditions.

Once it had been reframed as a new technology, cable was embraced by media activists and philanthropic organisations as a way to increase levels of public access to production, and enable a form of two-way participation in television. Streeter identifies a utopian belief in the forms of participation that cable technology seemed to offer, describing the tone and content of Report of the President's Task Force on Communications Policy, published in 1969:

This Report [⋯] vaguely but enthusiastically suggested that cable

10 Ibid., 234.

11 James W. Carey and James J. Quirk, cited by Streeter, 225.

12 Cited by Streeter, 224.

13 Ralph Lee Smith, *The Wired Nation: Cable TV: The Electronic Communications Highway* (New York: Harper and Row, 1972). Streeter also notes that the "wired nation" had previously been used by Harold Barnett, when testifying before a House subcommittee on CATV in 1969. Streeter, 232.

14 Smith, *The Wired Nation*, 83.

television, by allowing minorities and disaffected groups an outlet to express themselves and to communicate with the nation, might reduce their feelings of alienation and thus help solve the "problem" of the social unrest that was sweeping American society in 1968, particularly the unrest in black ghettoes. The Report also argued for an enhanced role for the federal government as a coordinator of the introduction of cable as a nationwide medium.[10]

Streeter suggest that such claims, in relation to the social and political significance of cable, were often highly influential and usually disconnected from pragmatic details, policy recommendations or any in-depth analysis of cable's interconnectedness with other elements of the television distribution network.

For Streeter, the utopian discourse surrounding cable technology offers an example of what James W. Carey and James J. Quirk call the "rhetoric of the electrical sublime".[11] This is a recurrent trope in US culture since the invention of the telegraph, expressing quasi-religious faith in the power of new technologies to overcome social and material problems. It is interesting to consider whether there is, or was, a connection between this quasi-religious faith in technology and the imagined movement of information through the air, as opposed to via ground transportation. While the interstate highways were heavy concrete objects, albeit often incorporating elevated junctions and interchanges, the technology of Community Antennae cable television could be imagined (albeit inaccurately) to involve in purely aerial transmission, readily associated with the realm of the blue sky.

The president's task force on communications was just one of many agencies shaping popular and political discourse around cable television during the 1960s. Streeter also cites the report of the advisory task force on CATV and telecommunications for New York City, which, following a lengthy discussion of the city's specific needs, concluded with a brief but significant statement on the "glittering promise"[12] of cable. This conclusion signaled the arrival of a new generation of "electronic circuits", to be used in banking and communications as well as entertainment. In 1970, *The Nation* – a left-leaning journal – published a special issue titled *The Wired Nation*, written by Ralph Lee Smith, which was rapidly expanded into a best-selling book.[13] Citing the federal subsidies for the interstate highway system in the 1960s as a precedent for investment in cable, Smith emphasizes the need to overlook "short-term commercial considerations".[14] He endorses a model of "broadband communications" in which cable companies would provide equal service to all communities and be reclassified as public utilities, subject to federal standards and regulations. This ideal model would include a public television system, enabling groups and individuals to access subsidised and regulated access to airtime and production facilities.

Paik's *Electronic Superhighway*

Although Paik had been interested in participatory television since the early 1960s, his report on *Media Planning for the Postindustrial Society* was a relatively late addition to the existing policy discourse around broadband communication networks. The report echoes some of the positions already outlined, advocating federal investment in telecommunications, and citing the building of the US interstate highways as precedent. Unlike Smith, however, Paik explicitly presents electronic communications

15 This is just one of several texts in which Paik advances an ecological rationale for the embrace of electronic communications. See David Joselit on Paik's ecology in *Feedback: Television Against Democracy* (Cambridge, Mass.; London: The MIT Press, 2007), 46-50.

16 Nam June Paik, interviewed by Lynn Hershman Leeson (1980). Published in *Electronic Superhighway: From Experiments in Art and Technology to Art After the Internet*, eds. Omar Kholeif, Sarah Perks and Seamus McCormack (London: Whitechapel Gallery, 2016), 223.

17 I am indebted to Gyung Eun Oh for her insightful response to my paper. Paik's exhibition in the German Pavilion at the 1993 Venice Biennale is documented on Medien Kunstz Netz website, http://www.medienkunstnetz.de/works/deutscher-pavillon/images/3/ (Accessed 20 October 2016).

18 Omar Kholief, "Electronic Superhighway: Toward a Possible Future for Art and the Internet," in *Electronic Superhighway: From Experiments in Art and Technology to Art After the Internet*, eds. Omar Kholeif, Sarah Perks and Seamus McCormack (London: Whitechapel Gallery, 2016), 28, note 20.

as a necessary and preferable alternative to what he calls "stressful" situations of automotive transport. In fact he proposes two-way video TV communications as an alternative to what he describes as the "effort to bring black and white children together by means of bussing", arguing that television can help to achieve "integration and understanding". Paik also advocates a more specifically ecological agenda, framing investment in electronic, paperless communications as a way to counteract "increased energy prices and a disturbed ecology."[15] He maintained a commitment to these ideas, as evidenced by a videotape interview conducted in 1980 by artist Lynn Hershman Leeson. An edited transcript of their conversation, which appears in the Whitechapel exhibition catalogue, includes this statement from Paik:

> If you telephone me instead of flying to New York, we not only save $300 air fare, we also save American Airlines gasoline [···] So we should move ideas and not weight [···] Transportation and communication are a trade-off. The more communication and less transportation we use, the better.[16]

So Paik seems to establish a fairly explicit opposition between two modes of circulation; (physical) transportation, involving weight and mass, and technologically-enabled communication, involving ideas.

In the early 1990s, Paik reasserted his role as an advocate of the electronic superhighway and half-jokingly claimed that his ideas were being appropriated by Bill Clinton and Al Gore. At this time, the Clinton presidential campaign was promising to invest in electronic communications and enable a participatory alternative to passive TV consumption. Paik responded to the revival of political interest in the participatory potential of broadband communications by producing a new multi-channel work. Entitled *Electronic Superhighway: From Venice to Ulan Bator*, it was realized for the German pavilion at the Venice Biennale in 1993 and incorporates material relating to John Cage, along with quotations from Paik's satellite broadcast *Wrap around the World*.

I am specifically interested in Paik's use of term "electronic superhighway" in titling his work(s) but it is important to note that the exhibition at the German pavilion also included other artworks. Paik created a site-specific video projection (titled *Sistine Chapel before Restoration*) and another multi-monitor work (*Phasen-Verschiebung*), which revisited the form and content of his 1965 installation *Moon is the Oldest TV*, along with numerous mixed media assemblages and sculptures referencing the figure and life of Marco Polo. As noted by Gyung Eun Oh, these works formed part of an exploration of different historical moments of cultural and economic exchange, extending from Marco Polo's famous journey (from Venice to Ulan Bator) to the era of global media communication.[17] This celebration of physical journeying and transport perhaps suggests an attempt by Paik to reconcile the opposition between "communication" and "transportation" outlined in his *Media Planning* report and subsequent interview with Hershman Leeson.

A second version of Paik's multi-monitor work *Electronic Superhighway* was produced in 1995, this time with a more specific focus on the US media economy and its political and physical geography. Subtitled *Continental U.S., Alaska, Hawaii,* it includes neon components delineating the borders of US states in what Omar Kholeif describes as a commentary on "the media saturation of capitalist America".[18] Both versions of *Electronic Superhighway* rework content drawn from broadcast sources, reiterating Paik's longstanding engagement with television as a potentially participatory medium. But, as Kaizen points out, Paik's multi-monitor pieces do not necessarily attempt to generate "two-way participation". Instead, he argues, they tend to "exaggerate

19 Kaizen, 238.

20 For an exploration of
    Smith's response to
    the highway, see David
    Salomon, "The Highway
    Not Taken: Tony Smith
    and the Suburban
    Sublime," *Places
    Journal*, September
    2013, Accessed 20
    October, 2016. ‹https://
    placesjournal.org/article/
    the-highway-not-taken-
    tony-smith-and-the-
    suburban-sublime/›

21 Michael Fried, "Art and
    Objecthood", *Artforum*
    (Summer 1967), 12-22.

22 Gillespie and Williams,
    cited by Stephen Graham
    and Simon Marvin,
    *Telecommunications
    and the City: Electronic
    Spaces, Urban Places,*
    (London and New York:
    Routledge, 1996), 57-58.

the pleasures and terrors of one-way information flow"[19], creating a mesmerizing effect rather than directly addressing the social and economic factors that shape contemporary information flows. Yet Paik's embrace of hypnotic repetition in multi-monitor works such as *Electronic Superhighway* could perhaps also be understood as an allusion, however oblique, to the "blue sky" discourse that Streeter examines in both the early 1970s and the mid-1990s, and the almost mystical properties and capacities for social transformation repeatedly attributed to communication technologies.

The Highway in Art Practice and Discourse

As already noted, advocates of the "superhighway" (even those, like Paik, who advanced an ecological critique of transportation) sought to invoke a history of federal investment in US infrastructure, exemplified by the road network. The highway functioned, within these policy contributions, as an emblem of what could be achieved through ambitious and systematic public planning, resourcing and regulation. But during the late 1960s, the interstate system also fascinated artists and cultural theorists because it offered a new way of understanding and experiencing relationships between bodies, objects and environments, with radical implications for the spatiotemporal experience of art.

Before turning to the exhibition at the Whitechapel Gallery, I want to briefly expand my discussion of circulation, and the infrastructural imaginary, to include an artist who is not associated with the use of electronic media. In an *Artforum* interview published in 1996, the architect and artist Tony Smith described a night-time road trip on the unfinished New Jersey Turnpike, undertaken with some of his students almost ten years earlier. Smith's vivid account suggested that temporal experience of the built environment could rival sculpture in terms of its aesthetic force and significance. Smith was particularly well placed to articulate the significance of the freeway as a concrete form with its own aesthetic properties, a vantage point from which to see the physical environment differently, and a technology enabling new forms of human movement.[20]

One year after the *Artforum* interview was published, Michael Fried drew on Smith's account of the freeway to theorize a major shift in the relationship between art object, event and site. But, even though infrastructural change contributed to this new relationship, the debates prompted by Michael Fried's text on "Art and Objecthood"[21] did not intersect with popular discourse around the electronic superhighway. The physicality of the freeway, as an elevated concrete object, is largely overlooked in the telecommunications policy documents I have cited. Reports such as Paik's *Media Planning* refer to the interstate system mainly as a precedent for federally-funded infrastructure, rather than dwelling upon the material properties or phenomenological experience of freeways. As I have noted, Paik also emphatically emphasizes the limits and failings of physical transport, both in his 1974 report and in his conversation with Hershman Leeson, explicitly advocating electronic communications as a more effective means of addressing both environmental and social problems.

Some theorists have argued that concrete and electronic infrastructures of circulation are best understood separately. For example, in a late 1980s analysis of the information economy and its implications for regional and urban development, Andrew Gillespie and Howard Williams suggest that the metaphor of an 'electronic superhighway' is potentially misleading, because it limits conceptualization of the specific role that technology can play in restructuring spatial relations. They point out that while conventional highway systems may reduce "the friction of distance," electronic communications have the capacity to entirely *collapse* distance.[22] But other

23 Margaret Morse, "An
    Ontology of Everyday
    Distraction: The
    Freeway, the Mall, and
    Television", in *Logics of
    Television*, ed. Patricia
    Mellencamp (London and
    Bloomington: BFI and
    Indiana University Press,
    1990), 193-222.

24 Raymond Williams,
    *Television: Technology
    and Cultural Form* (1974)
    (London and New York:
    Routledge, 2003), 19.

25 Tara McPherson,
    "Reload: Liveness,
    Mobility, and the Web,"
    in *New Media, Old Media:
    A History and Theory
    Reader,* ed. Wendy Hui
    Kyong Chun and Thomas
    W. Keenan (New York:
    Routledge, 2006), 199-
    208.

26 Samuel Greengard,
    The Internet of Things
    (Cambridge, Mass. and
    London: The MIT Press,
    2015).

theorists have argued for greater attention to the conceptual and economic linkages between concrete and electronic highways. These interdependencies are central, for example, to Margaret Morse's *An Ontology of Everyday Distraction: Television, the Freeway and the Mall*.[23]

In this text, which dates from 1989, Morse revisits Raymond Williams' concept of mobile privatization, developed (more than a decade earlier) to describe a complex of cultural, social and technological developments in post-war US society, whereby the car, the television and fridge both enabled and symbolized new modes of consumption, circulation and community.[24] Building upon Williams' analysis of the interdependencies between suburban home, television and car, Morse theorizes a state of distraction in 1980s US culture, which finds expression in flows of bodies, symbols and objects between television, the freeway and the mall. In her model, material infrastructures associated with road transport, broadcasting and retailing have become fully integrated, serving as the homogenous backdrop to distracted activities of driving, TV viewing and shopping. Interestingly, Morse also cites Tony Smith's recollections of the New Jersey Turnpike. But she frames his account as representative of the freeway experience in general, rather than engaging with his journey as a form of artistic research. As such, she somewhat overlooks the specific capacities and knowledges that artists bring to processes of infrastructural change.

Others, such as Tara McPherson, have revised the concept of everyday distraction in the post-internet era, placing greater emphasis on affect.[25] McPherson observes that movement online often does not feel orchestrated or sequenced (in contrast to television and perhaps the freeway), even though it is very easily tracked. Now that the internet has been wholly integrated into everyday practices of work and leisure, it seems all the more important to reconsider precisely how infrastructures for the circulation of bodies, data and objects intersect and overlap with each other. Clearly, there are important differences between transport technologies that simply reduce the friction of distance and communications media that can entirely collapse distance. These distinctions are, however, called into question by a whole range of technologies operating at the junction of transport, distribution and communication systems. They include (for example) 3D printing, augmented reality games, driverless cars, and a whole complex of developments associated with the "internet of things"[26], which clearly impact very directly upon practices of production and circulation in the era of what Kholeif and his co-curators term "art after the internet".

"Electronic Superhighway" at the Whitechapel Gallery

Accompanied by a fully illustrated catalogue and a program of related displays and events, the Whitechapel Gallery exhibition "Electronic Superhighway (2016-1966)" was an ambitious attempt to situate the work of contemporary artists engaging with the Internet as mass medium in proximity to earlier intersections between art and technology. Including seminal examples of Net.Art, video and experimental television, the exhibition traced the relationship between artists and technological change over a period of fifty years, from the *9 Evenings* event organized by Experiments in Art and Technology to the present moment. The Whitechapel Gallery also provided a potentially interesting setting for a show dealing with the concept of the 'superhighway' because of its location on a busy urban high street, with a facade that incorporates the entrance to the East Aldgate tube station. This direct, albeit mundane, connection between the gallery and the city's transport infrastructure was overlooked in the

27 Kholeif, "Electronic Superhighway," 28.

28 Iwona Blazwick, "Electronic Superhighway", in *Electronic Superhighway: From Experiments in Art and Technology to Art After the Internet,* ed. Omar Kholeif, Sarah Perks and Seamus McCormack (London: Whitechapel Gallery, 2016), 22.

29 Domanović has previously communicated this research interest through the display of timelines, popular cultural references and other data, either alongside or integrated into sculptural works, in exhibitions such as "The Future Was at Her Fingertips", Tanya Leighton Gallery, Berlin, 27 April-30 June, 2013.

exhibition design and literature, but longstanding associations between systems of transport and communications in media theory and art practice are acknowledged by various contributors to the exhibition catalogue.

Curator Omar Kholeif describes Paik's *Media Planning* report as a "foreshadowing of the information superhighway, or the network of all networks that we have come to know today", categorizing concept of the superhighway as "an allegory that opens the roads to our understanding of art and the internet – to a swathe of practices that are porous, contradictory and ever changing".[27] Elsewhere in the catalogue, Whitechapel Gallery Director Iwona Blazwick specifically frames the concept of the superhighway as "an evocation of speed and directional progress".[28] Referencing the use of steering wheels in video game technology, she seems to emphasize the action of driving, rather than engaging with the highway as infrastructure. Her allusion to speed also raises the question of whether the exhibition is interrogating, or simply reiterating, the late 1960s' concepts of technologically-enabled progress.

Significantly, within the gallery, the most recent works were located near the ground floor entrance, with older works encountered on the upper floor. This meant that the visitor effectively progressed backwards in time, moving through material explorations of social media and media-infrastructural critique, via Net.Art projects, interactive video installations and early computer-based animations, ending with a display of E.A.T. archive materials. Through this reverse chronology, reiterated in the catalogue design (which included a reverse timeline insert), "Electronic Superhighway (2016-1966)" seemed to both evoke and undercut a longstanding narrative of cultural and technological progress. Since the newest works were encountered first, their concerns provided a framework for older projects, including those engaging with the internet as a relatively new technology in the 1990s. Dialogue between these different historical moments was (perhaps as a consequence of the chronology) relatively limited, but there were some points of possible connection between past and present. For example, Alexandra Domanović's 3D printed sculptures of prosthetic hands – situated close to the entrance – are partly informed by her research into histories of women and technology. Her research framework was, however, less accessible in this presentation of her work than in previous exhibition contexts.[29]

Proceeding further into the ground floor gallery, the visitor encountered two works by Trevor Paglen. One work, titled *NSA-Tapped Fiber Optic Cable Landing Site, Mastic Beach, New York, United States* (2014), uses a mix of photography and cartography to investigate and materialize the relationship between surveillance and media infrastructure. The other is an object titled *Autonomy Cube* (2014), a collaboration with technology activist Jacob Appelbaum that superficially resembles a post-minimalist sculpture. The *Cube* houses several internet-connected computers and functions as an open Wi-Fi hotspot wherever it is installed. This network can be joined and used by anyone physically present in the gallery but the mode of connection is unconventional, particularly for a publicly-funded institution. This is because *Autonomy Cube* routes traffic over the volunteer-run Tor network, widely associated with activist critiques of corporate and government surveillance.

Autonomy Cube is a functional component of the Tor network infrastructure but it also explicitly evokes the historical intersection of art and cybernetics in the late 1960s. Through both its title and form, it clearly references Hans Haacke's *Condensation Cube* (1963-65), a canonical example of cybernetic art, which was designed to make visible the hidden engineering infrastructure needed to maintain constant levels of heat and humidity in art museums. Paglen and Appelbaum, like Haacke, engage with the material and organization systems that permeate art institutions, but they also frame

30 The works included are
Hito Steyerl's triptych
Red Alert, 2007 and Ryan
Trecartin's fusion of
reality TV and soap opera
in the single channel
video, *A Family Finds
Entertainment,* 2005.

31 Erika Balsom, "On the
Grid", in *Electronic
Superhighway: From
Experiments in Art and
Technology to Art After
the Internet,* ed. Omar
Kholeif, Sarah Perks and
Seamus McCormack
(London: Whitechapel
Gallery, 2016), 48-49.

the gallery as a networked node for the exchange and circulation of data. Significantly, and perhaps more than any other contemporary work in the "Electronic Superhighway" exhibition, *Autonomy Cube* manifests the infrastructure of circulation, in art and in the wider context of contemporary culture, as simultaneously institutional, material and social.

Paglen is just one of many artists currently articulating and negotiating radical transformations in the circulation and transport of bodies, data and objects. In recent years, numerous artists have focused on media infrastructures and associated technologies, including, drones, satellites, server farms and undersea cables. The exhibition also features works by Hito Steyerl and Ryan Trecartin, two artists that – in very different ways – have sought to dramatize and materialize socially-networked and geo-located image environments, objects, surfaces and bodies, through video, lecture-performance and sculptural installation. These specific concerns are not, however, particularly obvious in the actual works by these two artists in the exhibition.[30] It is possible that space restrictions, or other pragmatic concerns, prevented the inclusion of works such as (for example) Steyerl's *Factory of the Sun* (2015), discussed in Erika Balsom's contribution to the exhibition catalogue.[31]

Conclusion: Infrastructural Imagination

"Electronic Superhighway (2016-1966)" set out to explore and manifest the diversity of ways in which artists have registered and investigated the effects and properties of new technologies over the past five decades. The visitor was drawn (both imaginatively and physically) back in time to a moment characterized by rich and often unruly interconnections art practice and applied research, exemplified by *9 Evenings*, a seminal collaboration between organized by artists and engineers in 1966. Ultimately, however, it proved difficult to determine the differences, or parallels, between this moment and the cultural economy of contemporary art, which has informed and structured the production and distribution of the majority of post-2002 works presented in the ground floor gallery. Paik is clearly a crucial figure in understanding the changing relationship between art and technology during the period traced by the exhibition, precisely because of his involvement in media infrastructure policy as well as practice.

Through its evocation of Paik's thinking, "Electronic Superhighway (2016-1966)" offered a valuable opportunity to consider transformations in both transport and electronic communications infrastructures. But, perhaps inevitably – given its already ambitious scope – the exhibition did not engage with the specific discourses that informed Paik's report on *Media Planning*. This policy context could have been helpful in understanding how generations of artists have engaged with infrastructures of circulation. It would have allowed the exhibition to more fully address the specific role of the artist, in observing, articulating and shaping cultural, social and technological change. This task seems all the more pressing, given the proliferation of new infrastructures of circulation, many of which are prominently referenced in contemporary art.

There is a temptation for artists and curators to focus either on outmoded infrastructures, or on those that appear novel, visually compelling and even exotic, such as cave-like data centers. An emphasis on very old or very new technologies and systems can work against an understanding of many ways in which familiar and everyday technologies, involving broadcasting, mobile telecoms, satellites, train stations, ports and highways, are continually reconfigured and reimagined. It

remains equally important to engage with the legal, institutional, political and even administrative aspects of infrastructure, and also to consider how artists have sought to register and explore aspects of technological change at earlier moments in history. Paglen and Appelbaum's *Autonomy Cube* demonstrates that it is possible to integrate these approaches. By evoking the form (and the simple functionality) of Haacke's *Condensation Cube*, in the material manifestation of an anonymized communications network, this work provides a historical framework for art's engagement with the infrastructure of circulation.

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