Intermédialités
Histoire et théorie des arts, des lettres et des techniques
Intermediality
History and Theory of the Arts, Literature and Technologies

Divinations

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Number 13, Spring 2009

Programmer
Programming

URI: https://id.erudit.org/iderudit/044039ar
DOI: https://doi.org/10.7202/044039ar

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Publisher(s)

Centre de recherche sur l'intermédialité

ISSN

1705-8546 (print)
1920-3136 (digital)

Explore this journal

Cite this article

Kuo, M. (2009). Divinations. *Intermédialités / Intermediality*, (13), 38–55. https://doi.org/10.7202/044039ar

Article abstract

The essay “Divinations” focuses on Robert Rauschenberg’s *Oracle* (1962-1965), a work whose making and display entailed close collaboration between the artist and the engineers Billy Klüver and Harold Hodges, both of Bell Laboratories. The piece stemmed from Rauschenberg’s interest in sound, sculptural form, and radio networks: it housed ten radios and speakers in various sculptural elements constructed from found metal objects, including ducts, window frames, a bathtub, and a car door. Audience members could turn dials that indirectly modified the volume and tuning of the radios. Walking through the sculptural installation, one experienced shifting acoustic, spatial, and visual effects. This text seeks to understand how the interactions between artist and engineers—and between sound sculpture and viewers—engaged systems of industrial and postindustrial production, broadcast radio, and audiovisual reception.

Fig. 1: Robert Rauschenberg, *Oracle*, 1962-1965, a sound environment composed of five pieces in galvanised sheet metal, mounted on castors and each including a battery, a transmitter and a loudspeaker. Bath tub with shower (178 x 115 x 60 cm), staircase (149 x 140 cm), window-frame (158 x 236 x 47 cm), car door (160 x 133 x 85 cm), pipe (143 x 116 x 73 cm) © Succession Robert Rauschenberg/SODRAC (Montréal)/VAGA, New York (2010).

Divinations

Michelle Kuo

In January of 1962, Robert Rauschenberg began work with the Bell Laboratories engineers Billy Klüver and Harold Hodges. The process would culminate in *Oracle*, a multi-part sculpture completed and exhibited at the Castelli Gallery in New York in May 1965. Having met Klüver in 1960 during the engineer's collaboration with Jean Tinguely, Rauschenberg's continuing relationship with Klüver was to incur a major shift in the artist's work in the mid-1960s. Indeed, it would redefine Rauschenberg's practice through the deployment of collaboration: in *Oracle*, as we shall see, the contact between engineers and artists made possible an investigation of densely hybrid configurations of media and subjective experience, a foray into what could be called the "cybernetic" conditions of forecasting and prediction.[1]

When shown at Castelli in 1965 (as a photograph of the original installation shows), *Oracle* consisted of five assembled scrap-metal elements, each comprised of objects that Rauschenberg had found in the streets: a car door mounted on a typewriter table; a curved, elephantine exhaust pipe sitting on two wheels; a

1. This onset of Rauschenberg's so-called "technological" work has often been seen as a caesura, a demise into works that promoted an infantilizing, switch-like response in the viewer—thereby inscribing the very spectacularity and instrumentality in the aesthetic experience that his earlier *White Paintings* (1951-1953) and Combines had worked so hard to escape. Ironically, Rauschenberg's "technological" work is simultaneously accused of not being spectacular *enough*, of being technically simplistic and thus disappointing. But the paradoxical double bind of these arguments does not account for the hybrid nature and complex set of responses elicited by the work. On the infantilization of the participatory aesthetic and its increasing similarity to repressive administration, see Benjamin H. D. Buchloh, "Conceptual Art 1962-1969: from the Aesthetics of Administration to the Critique of Institutions," *October* 55, Winter 1990, p. 105-143. For an assessment of Rauschenberg's work in relation to regressive experience, see Branden W. Joseph, "Rauschenberg's Refusal," in Paul Schimmel (ed.), *Robert Rauschenberg: Combines*, Los Angeles and London, Museum of Contemporary Art and Steidl, 2005, p. 274-275.

cement-mixing tub with an air conditioning duct through which water gushed noisily, attached by a chain to a wire basket; a constructed aluminum staircase housing batteries and a control unit; and a window frame on casters with a smaller ventilation duct protruding from one side.[2] The disconnected parts were meticulously stripped of all paint and rested on the floor. A wireless control panel and five radios and transmitters were housed in the staircase, sending signals to the four other pieces—each of which contained a Comrex-brand receiver, a 10-watt amplifier, and a speaker.[3] This network converted *Oracle*'s sculptural components into an acoustic environment through which the audience could freely move. The audience could, in fact, alter the sounds themselves: through ten black dials on the control unit in the staircase, they were able to manually vary the volume and rate at which the AM band of each radio was being scanned. Yet one could not directly control the system; it was impossible to stop and "tune in" to any single station.[4]

Rauschenberg stipulated that no wires appear between the various parts of *Oracle*. "I wanted to do something that was remote control, that could be separate in the room," he said in 1965.[5] Klüver, too, understood that "the presence of wires would destroy the idea that the five elements [...] are completely independent units that can be moved to different positions and placed in different configurations."[6] This attempt to construct elements that were variable with each installation of *Oracle* seemed to stem from Rauschenberg's desire, throughout the 1960s, of realizing an all-encompassing environment that could react flexibly to stimuli such as bodily movement. *Broadcast*, in 1959, is the first overt manifestation of this desire: two knobs on the work's surface allowed the

2. Curatorial file, *Oracle*, Musée National d'Art Moderne, Centre Georges Pompidou, Paris. Additional descriptions of the components appear in Billy Klüver with Julie Martin, "Four Difficult Pieces," *Art in America*, vol. 79, n° 7, July 1991, p. 82-99 and 138; and Anon., "Technology and the Arts," *Bell Telephone Laboratories Reporter*, vol. 15, n° 2, March-April 1966, p. 16-19.

3. Klüver with Martin, 1991, p. 83; Billy Klüver with Julie Martin, "Working with Rauschenberg," in Walter Hopps and Susan Davidson (eds.), *Robert Rauschenberg: a Retrospective*, New York, Solomon R. Guggenheim Museum, 1997, p. 312-313.

4. Billy Klüver, "Oracle," in Cornelia Faist and Alfred Kren (eds.), *Robert Rauschenberg, Haywire: Major Technological Works of the 1960s* (exhibition catalogue), Ostfildern-Ruit, Hatje, 1997, p. 62-64.

5. Rauschenberg, interview with Dorothy Gees Seckler, December 21, 1965, Tape 2, Archives of American Art, Smithsonian Institution.

6. Klüver with Martin, 1991, p. 83.

viewer to manipulate both volume and station selection of three radios behind the panels. At the time, as Branden W. Joseph has argued, Rauschenberg saw *Broadcast* as an attempt to bring together different media under their shared qualities of duration and difference, so as to stave off the reification or stillness of the work.[7] Describing *Broadcast* in 1963, the artist stated, "Listening happened in time. Looking also had to happen in time."[8] Yet in the production of *Oracle*, Rauschenberg, Klüver, and Hodges were to fundamentally alter this quest for an experience of lived duration and change.

In fact, Rauschenberg had expressed a certain dissatisfaction with *Broadcast*: "I objected to the fact that one had to be standing so close to the picture that the sound didn't seem to be using the space and the way the images were reacting to each other."[9] This frustration with the spatial characteristics of *Broadcast* actually surfaced one year after the work's realization, when, in March 1960, Klüver encountered Rauschenberg at the Martha Jackson Gallery. Rauschenberg asked Klüver if it was possible to make an "interactive environment where the temperature, sound, smell, lights, etc., could be affected by the person who moved through it."[10] Over the next year and half, Klüver and his colleagues at Bell Laboratories explored this possibility in their spare time, bringing Rauschenberg into Bell for periodic discussions on the project.[11] "It proved impossible to

7. Joseph, 2005, p. 266. See also Branden W. Joseph, *Random Order: Robert Rauschenberg and the Neo-Avant-Garde*, Cambridge (Mass.), MIT Press, 2003, p. 186-187. Joseph insightfully places *Broadcast* and *Ace* (1962) at the beginning of a shift toward Rauschenberg's deconstruction of a televisual mode of apprehension, or scanning—what Brian O'Doherty described as Rauschenberg's "vernacular glance." See Brian O'Doherty, "Rauschenberg and the Vernacular Glance," *Art in America*, vol. 61, n° 5, September-October 1973, p. 85, and Brian O'Doherty, "Robert Rauschenberg I" (April 1963), in Brian O'Doherty, *Object and Idea: an Art Critic's Journal 1961-1967*, New York, Simon and Schuster, 1967, p. 112.

8. Gene R. Swenson, "Rauschenberg Paints a Picture," *Art News*, vol. 62, n° 2, April 1963, p. 45.

9. Rauschenberg, interview with Seckler, 1965, Tape 1.

10. Klüver with Martin, 1997, p. 312. See also Klüver, "Artists, Engineers, and Collaboration," in Gretschen Bender and Timothy Druckrey (eds.), *Culture on the Brink: Ideologies of Technology*, Seattle, Bay Press, 1994, p. 208; Klüver, 1997, p. 62.

11. As Klüver remembers, "I began thinking about some possibilities [in 1960], but nothing really happened until 1961 after the 'Art in Motion' show. To make him more familiar with what was going on, I brought Rauschenberg to Bell Laboratories." Klüver, 1997, p. 62. Klüver's characterization of the engineers' "free time" for pursuing the external project with Rauschenberg is of particular interest in terms of the working patterns

achieve [Rauschenberg's] original ideas for a multi-responsive environment," Klüver stated; having hit this dead end, Rauschenberg returned his focus to the manipulation of sound and radio.[12] Klüver and Hodges began work on designing a sound environment with five radios for which the volume and tuning control would be housed in a separate unit—thereby rupturing the audience's intimate interaction with *Broadcast* into a new relationship of remote control.

In January 1962, Rauschenberg, Klüver, and Hodges attempted to implant a system of radio receivers, amplifiers, and speakers into five canvas panels, which would be operated remotely from a central cabinet.[13] These panels would actually be diverted into use for the silent *Ace* (1962). But the notion of creating a sound environment persisted—albeit in a different form. Rauschenberg related:

> I had some canvases stretched, but it took so long I needed help with the radios. And it took so long for me to find the help that I used the paintings for something else. Then later I decided that was a good idea because once I started seeing what was involved I saw that with the weight problem, and the depth the painting would have to be to house the equipment, that painting was the wrong form for that to take. So I started on a sculpture.[14]

Visiting Bell Labs was integral in the reconceptualization and realization of this project. As the critic Gene Swenson recounted during a studio visit later that January,

> There had been several large metal objects in the corner of his studio the day he returned from the electronics laboratory [at Bell]. They began to occupy more and more of his interest, and over a period of time they were moved to his central working area. There were five pieces and he planned to put a radio into each of them; he also played with the idea of using running water, and eventually one of the pieces of the "concert project" became a fountain.[15]

of Bell: "We would only work on it in our 'free' time, which really meant that we took the time for it whenever we chose. Bell Laboratories, like any good research laboratory, left us alone to carry on our own experimental or theoretical research. During this time, I brought Rauschenberg to Bell Labs to see what my colleagues and I were working on." Klüver with Martin, 1997, p. 312.

12. Klüver, 1997, p. 62.

13. Gene R. Swenson described this arrangement during his studio visit in January 1961. See Swenson, 1963, p. 45-46.

14. Rauschenberg, interview with Seckler, 1965, Tape 1.

15. Swenson, 1963, p. 46. In autumn 1962, Rauschenberg used several of these sculptural elements (without radio) in the "Dylaby" (Dynamic Labyrinth) exhibition at the Stedelijk Museum, Amsterdam, occasioned by the museum's outgoing director Willem

Rauschenberg began work with Klüver and Hodges on a design using five AM transistor radios—the artist insisted on using the AM band, because at the time FM only broadcasted "'cultural programs'—classical music, etc." as Klüver put it.[16] Rauschenberg's request for a completely wireless system made the process much more complex and difficult.[17] After encountering a "nightmare of noise" with homemade AM transmitters, which operated on too broad a frequency band, Klüver and Hodges attempted to re-engineer a wireless radio transmitter they purchased for $3.50.[18] Hodges devised a unique drive mechanism, via a small, variable-speed DC motor that continually rotated the tuner for the radios back and forth across the frequency band.[19] Varying the voltage on the motors would alter the scanning speed—but any modulation of the speed would be continually altered by feedback: the motor constantly self-adjusted so that one could never directly control the scan or settle on one station.[20]

Further problems with interference and the transmitters stalled Klüver and Hodges until the summer of 1964, when, as Klüver said, "technology caught up with us."[21] They purchased one of the first fully transistorized wireless microphone systems, which included a much more powerful set of transmitters and receivers, and connected it to Hodges' motor system. (Transistorized, portable equipment like radios and amplifiers had just barely come onto the market by the early 1960s.) At this point, Klüver and Hodges were helping to shape crucial

Sandberg (who also presided over "Art in Motion"). Pontus Hultén had organized the show, bringing Jean Tinguely, Niki de Saint Phalle, Martial Raysse, Per Ultvedt, and Daniel Spoerri to the museum, where each artist generated a site-specific installation. See Rauschenberg, interview with Seckler, 1965, Tape 1.

16. Klüver with Martin, 1997, p. 312; Klüver with Martin, 1991, p. 83.

17. Klüver explained, "Of course, if he [Rauschenberg] had allowed us to use wires to connect the control console with the other units, the solution would have been simple." *Ibid*.

18. Interestingly, the prefabricated parts obtained by Klüver and Hodges were devised to create a kind of domestic ambient sound system: the "Cordover FM Wireless Phono Transmitter" was originally marketed for the transmission of phonograph sound in the home. As Klüver related, "according to the manufacturer, '[it] contains complete solid state electronic circuitry ready for immediate use as an efficient means of wireless transmission of music from the tone arm magnetic cartridge of a phonograph into any FM radio in the home.'" *Ibid*.

19. *Ibid*.

20. "Rauschenberg didn't want the viewer to be able to 'tune in' one given station, and Harold's scanning system made this virtually impossible," Klüver wrote. *Ibid*.

21. Klüver with Martin, 1997, p. 312; Klüver with Martin, 1991, p. 83.

features in the work—even formal aspects that were arbitrary from an engineering standpoint. If Rauschenberg decided on the size and shape of the control knobs and the size of speakers, Klüver and Hodges worked with the artist on where to put the components and the layout of the receiving antennas. And when Klüver could no longer make midnight requisitions of Bell Labs telephone batteries to repurpose for *Oracle*'s radios, he bought the only substitute he could find—bright red RCA batteries. The red batteries became the only instance of visible color in the piece, until they, too, were discontinued by their manufacturer.[22] These components were not simply akin to found objects but were interchangeable parts that could be replaced over time.

On the level of the network itself, *Oracle* made use of an actual control mechanism, also known as a *servomechanism*. This is a type of device that uses a feedback loop, acting continuously on the basis of incoming information, to attain a specified goal in the face of changes.[23] The system of motors that Hodges devised was one such control mechanism: it constantly adjusted to dynamically changing input from the audience's manipulation of the dials on *Oracle*'s control unit. If the speed of the motors increased or decreased beyond a certain point, the system would self-correct toward an average speed—and thereby modulate the rate at which the radios were changing frequencies.

Oracle's motor system thus approximated a simple model of contemporary cybernetics, the theory of control mechanisms developed over several decades beginning in the 1920s and named by mathematician Norbert Wiener in the mid-1940s. The growth of the field of cybernetics is popularly associated with Wiener's World War II research in anti-aircraft missile technology—how to aim at a target whose velocity, acceleration, and direction is constantly changing by making a dynamic series of statistical estimates about the future positions of the target. (The term cybernetics stems from the Greek *kubernétes* (κυβερν–ητης), an etymology shared by the words "steersman" and "governor".) Wiener's famous book, *Cybernetics: or Control and Communication in the Animal and the Machine*, was published in 1948; it was followed by another version in 1950, *The Human Use of Human Beings: Cybernetics and Society*, which was aimed at lay

22. *Ibid*., p. 84; Klüver with Martin, 1997, p. 313.

23. For one of the earliest and most comprehensive texts explicating the theory of the servomechanism, from the MIT Radiation Laboratory, one of the centers of control mechanism research, see: James Hubert Maxwell, *Theory of Servomechanisms*, MIT Radiation Laboratory Series 25, New York, McGraw-Hill, 1947.

audiences and was a mainstream success.[24] The text argued for the wide application of cybernetic theorems to the life sciences, sociology, and ecology, among others.

But it bears saying that this fixation on Wiener as the fount of cybernetics, propagated by cultural historians over the last decade, is largely inaccurate (or at least disproportionate). In fact, cybernetics was also and more specifically rooted in a number of prewar engineering milieus, *prior* to Wiener's innovations. The first of these was intimately related to Klüver: the electronic control systems innovations of the engineer Harold Black, at none other than Bell Laboratories. In 1927, Black developed the negative feedback amplifier, one of the earliest uses of negative feedback and a defining moment in the field of modern electronics. As historian David Mindell has demonstrated, feedback applications and the major concepts of cybernetics were also developed in highly different contexts and discourses throughout the 1920s and 1930s, not only at Bell, but at Vannevar Bush's laboratory at MIT (Shannon was Bush's doctoral student at MIT), the naval research laboratories, and the Sperry Gyroscope Company.[25]

24. Norbert Wiener, *Cybernetics: or Control and Communication in the Animal and the Machine*, Cambridge (Mass.), MIT Press, 1948; Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society*, Boston, Houghton Mifflin Harcourt Publishing Company, 1950. For a detailed history of the broader development of cybernetics through the Macy Conferences on Cybernetics, 1946-1953, see Steve Joshua Heims, *The Cybernetics Group*, Cambridge (Mass.), MIT Press, 1991. The conference participants—Norbert Wiener, Heinz von Foerster, John von Neumann, Margaret Mead, Gregory Bateson, Warren McCulloch, Walter Pitts, Kurt Lewin, F. S. C. Northrop, Molly Harrower, and Lawrence Kubie—met annually to discuss the interdisciplinary applications of cybernetics, game theory, information theory, and other fields.

25. David A. Mindell, *Between Human and Machine: Feedback, Control, and Computing before Cybernetics*, Baltimore, Johns Hopkins University Press, 2002, p. 105-137 and 276-306. See also Hendrik W. Bode, "Feedback: the History of an Idea" (1960), in Richard E. Bellman and Robert Kalaba (eds.), *Selected Papers on Mathematical Trends in Control Theory*, New York, Dover Publications, 1964; and Hendrik W. Bode, *Synergy: Technical Integration and Technological Innovation in the Bell System*, Murray Hill, Bell Laboratories, 1971; Stuart Bennett, *A History of Control Engineering, 1930-1955*, London, Peter Peregrinus, 1993. Wiener's own anti-aircraft missile work at the National Defense Research Committee (founded by Vannevar Bush) was actually conducted under the auspices of Warren Weaver, who would terminate Wiener's contract after two years (and who was simultaneously funding researchers at Bell and MIT), and subsequently penned the introduction to Shannon's *Mathematical Theory of Communication*. After Wiener's termination, his main purpose seemed to be to convert cybernetics from a military to a civilian field of inquiry. Doing so, however, entailed a denial of the military context

Moreover, cybernetics was closely related to Shannon's research on communications theory at Bell. Both fall under a broad rubric of efforts to control dynamic systems; the two were nearly simultaneously developed (Shannon's paper on information theory, we should recall, was published in 1948). Black's work, for example, was part of a nexus of research at Bell that was subsequently furthered by Harry Nyquist, whose classical work on the stability of feedback amplifiers yielded axioms pertaining to feedback control theory, bandwidth requirements, and thermal noise, each of which was instrumental for Shannon's information theory and the understanding of feedback and dynamic systems.[26] While the broader implications of control engineering research are beyond the scope of this article, I want to note here the way in which *Oracle* can be understood as both firmly embedded within and yet keenly troubling this discourse of cybernetics and servomechanisms—of violence, information, and control.

For, if cybernetics—and the devices whose properties it defined—was predicated on the regulation and adjustment of dynamic systems, *Oracle* was a system that also activated its own interruption or diversion. Indeed, the work was an uncanny, heterogeneous mix of industrial detritus, re-engineered objects, consumer devices, and a startling array of *flows*: actual currents of information, radio waves, water, air, sound, electricity—and of course the ventilation streams suggested by the use of air-conditioning ducts and exhaust pipes. Yet these flows were not seamlessly integrated into some controlled, systematic circuit. On the contrary, they interacted in a perpetual stutter of fissures and lags, interference and dead air. Rauschenberg had chosen to use small speakers with poor sound quality, which were installed differently in each piece and to extreme acoustic

that had spawned his own research: "For Norbert Wiener, in the midst of the technological war, cybernetics became a civilian enterprise. Most indicative of this alienation and reconstruction is Wiener's consistent failure to acknowledge the multiple traditions of feedback engineering that preceded him. In all his writing on cybernetics he never cited Elmer Sperry, Nicholas Minorsky, Harold Black, Harry Nyquist, Hendrik Bode, or Harold Hazen. All had published on the theory of feedback before 1940; all were recognized as important to the field; all had speculated on the human role in automatic control; some had even written on the merger of communications and control or on philosophies of feedback. […] The omissions are striking. […] Wiener gave cybernetics an intellectual, scientific trajectory, divorced from the traditions of technical practice from which it sprang," Mindell, 2002, p. 286.

26. David A. Mindell, "Opening Black's Box: Rethinking Feedback's Myth of Origin," *Technology and Culture*, vol. 41, n° 3, July 2000, p. 426-429; Bennett, 1993, p. 82-84; E. Colin Cherry, "A History of the Theory of Information," *Proceedings of the Institution of Electrical Engineers*, n° 98, September 1951, p. 386.

effect: in the window, the speaker is in the metal duct which gives enormous resonance to the radio's sound and makes it nearly impossible to understand any words; while the exhaust pipe's speaker is attached *inside* the pipe, outside facing in, so that the sound is projected through the pipe like a deeply pitched vibrating horn.[27] In the car door, the speaker is attached to the back of the door; in the tub it is in the small wire basket. In the stairs, the sound comes directly from the radio itself. Klüver described the experience "as if you were listening to someone else's radio receiver… bits of music, talk and noise—loud, soft, clear or full of static;" the choice of station was not ultimately up to you, nor the actual qualities of the sounds.[28] Persistent background noise is audible from the motors, interference from the radios is continual, and from certain vantage points the rushing sound of the water drowns out the rest of the sounds—a phenomenon related in Klüver's and critics' accounts and confirmed in my own observation of *Oracle*.[29]

This tense coupling of a wireless, networked environment and the inert, industrial waste or castoffs of doors and pipes and windows confirmed the *paradox* of the post-World War II world in the mid-1960s—a moment that Jonathan Crary has described as "a planetary data-communications network physically implanted into the decaying digressive terrain of the automobile-based city… [into] the rotting edifices of a previous theater of modernization."[30] For Crary, drawing on Gilles Deleuze and Félix Guattari's periodization of a "cybernetic phase of capitalism," the development of cybernetics stood at the nexus of this enforced conjugation.[31] It was a shift motivated by the "obliteration of outdated territories, languages, filiations, of any boundaries or forms that impeded the installation of cybernetics as the model for the remaking of the world as pure

27. Klüver with Martin, 1991, p. 85; Klüver, 1997, p. 65.

28. Klüver with Martin, 1991, p. 85.

29. One critic highlights "the very real sounds of the radios and the very unreal appearance of his landscape. Interferences become static and the silences are overbearingly exclusive." Neil A. Levine, "Robert Rauschenberg" *Art News*, vol. 64, September 1965, p. 11.

30. Jonathan Crary, "Eclipse of the Spectacle," in Brian Wallis (ed.), *Art After Modernism: Rethinking Representation*, New York and Boston, New Museum of Contemporary Art and David R. Godine, 1984, p. 291.

31. *Ibid.*, p. 286, note 9. Deleuze and Guattari, drawing on Lewis Mumford's notion of the "megamachine," describe an expanding cybernetic phase of capitalism that threatens to achieve a global "generalized enslavement" through digital and telecommunications networks. See Gilles Deleuze and Félix Guattari, *Mille Plateaux*, Paris, Les Éditions de Minuit, 1980, p. 30.

instrumentality."[32] Indeed, cybernetics—the science of "control and communication," as Wiener called it—had come to mythically stand for the totality and instrumentality of late capitalism and the military-industrial complex. Cybernetics marked nothing less than the emergence of a "society of control," to use Deleuze's well-known formulation.[33] Yet *Oracle* forced this cybernetic system into relation with the inert objects it had supposedly left in the past. *Oracle* was not simply a way out of reification and congealment, the stasis of paintings or aesthetic objects that Rauschenberg had so often spoken fearfully of. Rather, the work *disturbed the cybernetic system*, a system already predicated on constant change itself. If cybernetics was based on futurity, on predictions and their regulation, *Oracle* seemed to foil this divinatory function.[34]

32. Crary, 1984, p. 292. "And it cannot be overemphasized," Crary continues, "how the development of cybernetics ('a theory of messages and their control') is intertwined with the commodification of all information and with the hegemony of what [Thomas] Pynchon calls the 'meta-cartel.'" *Ibid*.

33. Gilles Deleuze, "Postscript on the Societies of Control," *October* 59, Winter 1992, p. 3-7. According to Deleuze, the transition from a Foucauldian notion of disciplinary societies to "societies of control" is incarnated in the dissipation of architectural or physical structures of discipline and enclosure into dematerialized networks of control. Inherent to the control society is the rise of the computer, superseding those machines "involving energy, with the passive danger of entropy and the active danger of sabotage." This shift mirrors the various types of cybernetic systems, mechanical and digital. What *Oracle* underscores, I would argue, is the crisis entailed in the overlay of these two regimes, one supposedly fading and the other ascendant. On the role of cybernetics within the emergence of so-called "control societies," see also Gilles Deleuze, "Control and Becoming" and "Postscript on Control Societies," *Negotiations: 1972-1990*, trans. Martin Joughin, New York, Columbia University Press, 1995, p. 169-182.

34. The sculptural components of *Oracle* directly cite the found objects (pipes, chains, wheels) in a number of previous works dating approximately from 1961 and exhibited at Castelli that year, such as *Empire II* and *Trophy IV (For John Cage)*. I understand these works as explorations in sculptural assemblage that presage Rauschenberg's investigation of the found object, "found" telecommunication networks, and acoustic space in *Oracle*. On the Castelli exhibition, see Joan Young and Susan Davidson, "Chronology," in Hopps and Davidson (eds.), 1997, p. 560. In a related but differently oriented reading of this work of 1961-1962, Joshua Shannon focuses on the contrast between the material specificity of Rauschenberg's discarded urban construction elements and "the abstraction of the built environment" in New York City (through the advent of International Style architecture and simulacral systems of advertising). Shannon, however, describes a definitive break in Rauschenberg's work in 1962, between an "end" of the artist's Combines in that year and his subsequent series of silkscreens—whereas *Oracle* and its production between 1962-1965

In this, *Oracle* might seem wholly allied with the investigation of telecommunications systems in the contemporaneous *Ace*. Joseph has demonstrated that *Ace* induced a mode of spectatorship akin to televisual scanning.[35] The work rejected the sheer quantity and variety of pictorial incident (such as legible text) in *Broadcast* and other previous Combines in favor of a more homogenous visual field that could be taken in at a distance, inaugurating Rauschenberg's subsequent inquiry into the spatiotemporal manipulations of broadcast television, its artificial compression of the anachronistic and remote. Yet, as we have seen, Rauschenberg deliberately rejected using an actual remote control system in *Ace*—choosing instead to deploy the remote control structure in the spatially dispersed, three-dimensional ensemble of *Oracle*.

Why this switch? Why, exactly, did Rauschenberg declare that "painting was the wrong form for [the radio system] to take"?[36] The answer, I think, is that *Ace* began one trajectory in Rauschenberg's work, *Oracle* another: *Oracle* represented an exploration of dynamic *radio* networks as opposed to the transmitted images of television. Whereas *Ace* and Rauschenberg's subsequent works in silkscreen and paint effected a critique of televisual spectacle and the status of the screened image (as Joseph has shown), *Oracle* mounted a systematic interrogation of the kinetic, acoustic, and privatized space of the transistor radio. And to fully engage this dynamism of radio demanded a *sculptural* investigation into how radio continually shifted and organized the space of reception.

Indeed, it was not simply the physical stasis of works such as *Broadcast* and *Ace* that perturbed Rauschenberg (as he told Klüver in 1991, "I was envious of the current and endless changes of information [in radio] as opposed to fixed images").[37] It was also the relative immobility of the spectator standing in front of a flat, two-dimensional, screen-like image. Rauschenberg therefore worked to insure a dislocation of sensation and movement in *Oracle*'s audience. He told Seckler, "You had a sense of distance that as often as not was distorted. You had the feeling possibly of knowing where you were but where you were was lost."[38] This disorientation of individual space in *Oracle* drew attention to

would seem to acutely complicate any binary division between the Combines and silkscreens. See Joshua A. Shannon, *Black Market: Materiality, Abstraction and Built Environment in the New York Avant-Garde, 1958-1962*, doctoral thesis, Berkeley, University of California, 2005, p. 201-206.

35. Joseph, 2003, p. 186-187.

36. Rauschenberg, interview with Seckler, 1965, Tape 1.

37. Rauschenberg, interview with Klüver, March 1, 1991, cited in Klüver, 1997, p. 62.

38. Rauschenberg, interview with Seckler, 1965, Tape 2.

the experience of radio as both public and intensely private. With the advent of the portable transistor radio, the public, intersubjective space of broadcast networks (the saturation of radio wave signals throughout lived space) necessarily coexisted with the privatized and mobile aural space of the individual (the sole listener, whom the transistor radio device isolates in an intimate and delimited sonic field).

It is precisely this *frisson* that characterized the bifurcation between the two major discourses on radio concurrent with *Oracle*: Cage's view of radio as an omnipresent ether, versus Marshall McLuhan's understanding of radio as engendering a privatized auditory space. On the one hand, *Oracle* closely resembled Cage's first piece to incorporate radio, *Imaginary Landscape No. 4* (1951). Cage wrote the work for twelve radio receivers, each of which had a dial for volume control and a dial for tuning. Two performers were to vary the volume and frequency through these dials.[39] But *Oracle* extends the active role of the "performer" to any passerby; it impedes the direct relationship between the body, mechanical controls, and tuning/volume output; and it embeds the radio system in resolutely heavy, lumbering, and dispersed sculptural form.

In 1966, one year after *Oracle* made its debut, Cage told Morton Feldman in a "radio happening" on New York's WBAI, "But all that radio is, Morty, is making available to your ears what was already in the air and available to your ears, but you couldn't hear it… all it is is making audible something which you're already in. You are bathed in radio waves."[40] Cage's aim was to induce a perceptual revelation of this (ordinarily imperceptible) permeation of radio.[41] Radio

39. First performed publicly near midnight in January 1952 at Columbia University's McMillin Theater, *Imaginary Landscape No. 4* lasted four minutes and thirteen seconds. Few sounds were actually heard, because the majority of the local radio stations had signed off the air by that time of the evening.

40. John Cage, cited in "Radio Happenings: Recorded at WBAI, NYC 7/9/66-1/16/67," in Peter Gizzi (ed.), *Exact Change Yearbook No. 1*, Boston, Exact Change, 1995, p. 256. On the exchange between Cage and Feldman, see Joe Milutis, "Radiophonic Ontologies and the Avantgarde," in Allen S. Weiss (ed.), *Experimental Sound and Radio*, Cambridge (Mass.), MIT Press, 2001, p. 57-72.

41. Cage believed that exposure to and perceptual awareness of radio's overriding network held liberatory promise, but this is not to say that his view of technology was simplistically utopian—far from it; it is rather to argue that Rauschenberg built on the implications of Cage's investigation of radio in order to take it into an overtly spatial direction. In this, I would differ from numerous critics' characterization of Cage's conception of technology as overly naïve or romantic. For such a perspective, see Kathleen N. Woodward, "Art and Technics: John Cage, Electronics, and World Improvement," in Kathleen

thus functioned as an increasingly important element of Cagean silence. It represented a new permutation of Cage's aspiration toward a radically multiplicitous experience of the world and, with it, a liberating evasion of the administered sameness of technocratic rationality. Yet Cage's embrace of radio did not fully recognize the degree to which commodity production was transforming from the logic of standardization toward that of asymptotic differentiation. Building on Cage's work and yet surpassing certain of its limitations, *Oracle* confronted the ways in which radio's plenary diversity was also a sophisticated realization of the customization of capital and the privatization of networks and spaces.

Oracle realized seminal aspects of what McLuhan termed radio's "acoustic space"—a realm that did not posit geometrical spatial relations, that possessed neither center or periphery, since hearing occurs from all directions simultaneously.[42] With radio, however, acoustic space was experienced not simply as an abstract morass (as reductive readings of McLuhan tend to portray the concept). Rather, it was a materially concrete and molecularized phenomenon. The media theorist argued that radio now possessed unprecedented power to "involve people in depth," especially with those "who carry transistor sets in order to provide a private world for themselves amidst crowds."[43] As *Oracle* enabled its audience to

N. Woodward (ed.), *The Myths of Information: Technology and Postindustrial Culture*, Madison, Coda Press, 1980, p. 171-192.

42. McLuhan based his well-known concept of "acoustic space" on the work of the behavioral psychologist E. A. Bott, his peer at the University of Toronto. Against the linear, fragmented order of vision and the printed word, McLuhan proposed that acoustic space defined the nodal, relational, and decentered network of electronic communications. See Marshall McLuhan, *The Gutenberg Galaxy: the Making of Typographic Man*, Toronto, University of Toronto Press, 1962. The notion of an aural (and non-visual) ordering of space also developed in the discourse on film sound, most notably by Christian Metz in his seminal essay "Aural Objects." As Metz wrote, the "spatial anchoring of aural events is much more vague and uncertain than that of visual events. The two sensory orders don't have the same relationship to space, sound's relationship being much less precise, restrictive, even when it indicates a general direction (but it rarely indicates a really precise site, which on the contrary is the rule for the visible)." Christian Metz, "Aural Objects" [1975], trans. Georgia Gurrieri, *Yale French Studies*, n° 60, 1980, p. 29-30.

43. Marshall McLuhan, "Radio: The Tribal Drum," in *Understanding Media: the Extensions of Man* [1964], Cambridge (Mass.), MIT Press, 1994, p. 298. Here, McLuhan cites Bertolt Brecht's "Radio Poem," n. d., in this regard; Brecht was, of course, one of the most acute observers of the empathic intensity of radio and its potentially revolutionary effects: "There is a little poem by the German dramatist Bertolt Brecht: 'You little box, held to me when escaping/So that your valves should not break,/Carried from house to

adjust the work's transistor radios (albeit not as handheld transistors, a technology that would be utilized the next year in the performance series *9 Evenings: Theatre and Engineering* as well as in the Pepsi Pavilion, constructed by Experiments in Art and Technology for Expo '70 in Osaka, Japan) and choose their own listening position among both diffuse and focused channels of sound, the work bore out McLuhan's assertion that "Radio affects most people intimately, person-to-person, offering a world of unspoken communication between writer-speaker and the listener. That is the immediate aspect of radio. A private experience."[44] After the mainstreaming of television, according to McLuhan, radio had diversified into an unprecedented medium for regional and local service, becoming specialized in both "content" and physical location with "the multiplicity of receiving sets in bedrooms, bathrooms, kitchens, cars, and now in pockets."[45] *Oracle* reproduced this monadic particularization of reception. At the same time, however, the work also staged the inevitable connections *between* such intimate and discrete points of listening.

Oracle thus dislocated the supposed fixity and determinedness of broadcast radio networks. And it did so not only on the level of reception. If radio has preoccupied the modernist imagination, from Marinetti to Khlebnikov, Brecht to Artaud, it is the *apparatus* of radio itself—the parceling of its mechanisms, the slicing and selling of radio airwaves—that has haunted otherwise triumphal declamations of the medium's political potential as a participatory communication system, most notably in the critiques proffered by Theodor Adorno, Hans Magnus Enzensberger, and Jacques Attali.[46] It makes sense, then, to view

ship from ship to train,/So that my enemies might go on talking to me/Near my bed, to my pain/The last thing at night, the first thing in the morning,/Of their victories and of my cares,/Promise me not to go silent all of a sudden.'"

44. McLuhan, 1994, p. 299. It was in this sense that, for McLuhan, radio was a "hot" medium, whereas television was "cool;" moreover, the private auditory space of radio aroused an unmatched intensity of individual (and primordial) affect: "The subliminal depths of radio are charged with the resonating echoes of tribal horns and antique drums. This is inherent in the very nature of this medium, with its power to turn the psyche and society into a single echo chamber." *Ibid*.

45. McLuhan continues, "Different programs are provided for those engaged in diverse activities. Radio, once a form of group listening that emptied churches, has reverted to private and individual uses since TV. The teenager withdraws from the TV group to his private radio." *Ibid*., p. 306.

46. See Hans Magnus Enzensberger, "Constituents of a Theory of the Media," *New Left Review*, vol. 1, n° 64, November-December 1970, p. 13-36; Jacques Attali, *Noise: the Political Economy of Music*, Minneapolis, University of Minnesota Press, 1985.

Oracle in terms of these historically specific conditions of radio production and broadcasting—in contrast, again, to the artist's engagement with television or film.[47] *Oracle* directly engaged the recent development of the portable transistor radio and its privatization (both physical, *à la* McLuhan, and commercial), only to operate in its gaps, its lacunae. Indeed, in 1962, Rauschenberg and Klüver were confronting severe signal interference in their configuration of radios and transmitters. So they decided to use the "empty spots" in the existing broadcast frequencies: as Klüver remembered, "The solution to the problem of interference was to retransmit the AM signal in a different frequency band. We decided to use the empty spots in the FM band (in the early 1960s there were very few FM stations)."[48] As they continued to grapple with interference problems, the project began to resemble a kind of pirate radio, taking over spaces in the spectrum that were leftover, unoccupied.

Oracle, in other words, was a kind of pirate radio. And it was precisely this mode of illicit "ham" operation that Adorno, writing in 1941 during his research for the Princeton Radio Project, saw as literally interfering with commercially standardized radio and its characteristics of unity, reification, quotation, and "atomization."[49] For Adorno, radio exhibited a major tendency toward standardization that paralleled monopolistic economic structures (what he termed "Ubiquity-Standardization"), but also countertendencies. This made for a continual push and pull between an illusion of "hereness," specialization, and authenticity in the radio experience, and a uniformity that pervaded the production of radio—a tension that could equally well describe the dynamics of *Oracle*. Adorno noted, "As the power of radio stations, and especially the large networks increases, they try more and more to maintain a diversity of programs at the same

47. For analyses of Rauschenberg's work of this time in terms of television and film, see Joseph, 2003, p. 275.

48. Klüver with Martin, 1991, p. 83.

49. Theodor W. Adorno, *Current of Music: Elements of a Radio Theory*, trans. Robert Hullot-Kentor, Frankfurt, Suhrkamp Verlag, 2006. As Adorno elaborates, "In other words, through radio, the individual elements of symphony acquire the character of quotation. Radio symphony appears as a medley or potpourri in so far as the musical atoms it offers up acquire the touch of having been picked up somewhere else and put together in a kind of montage." All too often, this montage gave rise to sonic simplicity and uniformity: "[I]n the symphonic field those works surrender themselves to radio most readily which are conglomerates of tunes of both sensual richness and structural poverty—tunes making unnecessary the process of thinking which is anyhow restrained by the way the phenomenon comes out of the radio set." *Ibid.*, p. 263, 268.

time."[50] By operating in the empty spots of existing frequency channels, *Oracle* matched the localized, concrete, bodily apprehension of noise in radio with the interstices of commercial radio's broad sweep. Indeed, *Oracle* called attention to the aural deficits of radio as well—foregrounding the compression of sound waves in radio, the resolutely *monophonic* result of the device: radio broadcasting could not produce stereo sound and, as such, fundamentally differed from normal listening experience. Despite radio's affinity to "live sound," an approximation far closer than television's similitude to "live action" (as McLuhan and others observed), radio was still marked by a distortion of sound. Moreover, Adorno noted that all radio sound was pervaded through a unifying electric current of noise, or what he called a "hear-stripe"—akin to the screen upon which filmic images were projected. By abdicating control of the tuning dials to the spectator, who could turn these controls at will, *Oracle* uncannily enacted the one possibility of unsettling this mediation that Adorno allowed: "Perhaps if it were possible to play 'upon the electric current' of radio, in the sense that one can play on a piano or violin, the hear-stripe would disappear. Under present conditions, however, we know that such a suggestion sounds utopian."[51]

In fact, one could argue that the divinations of the cybernetic system were seemingly mirrored in the determined, standardized broadcast radio networks. And it becomes clear that *Oracle* seemed to adopt and disrupt each facet of this system, upending its smooth transmissions, its bandwidths of transmission, its acoustic plenitude, its "hear-stripe." *Oracle* begins to appear as nothing less than a double deterritorialization of the cybernetic phase of capitalism (so harrowingly outlined by Deleuze)—and thus of the field of technological innovation and control.[52] Radio itself has been a medium continually on the verge of being outmoded, superseded first by television and now adaptively resurrected via digital technologies ("internet radio")—a perpetual condition of displacement incarnated in the evolution of *Oracle* itself.

50. *Ibid*., p. 150.

51. *Ibid*., p. 178.

52. As Deleuze argued, *music* effects a kind of sonic dematerialization of the body, a form of "becoming molecular," an entity that is never fixed into a pattern of organization or regulation: music incurs a "deterritorialization of the refrain," an open structure that disrupts the refrain or rhythmic motif that often structures "an organism's milieu, territory, or social field." See Gilles Deleuze and Félix Guattari, "Becoming-Music," in *A Thousand Plateaus: Capitalism and Schizophrenia* [1980], trans. Brian Massumi, London, Continuum, 2003, p. 299-309. On Deleuze's reading of music, see Ronald Bogue, *Deleuze on Music, Painting, and the Arts*, London, Routledge, 2003, p. 3.

For even as *Oracle* converted bodily and phenomenological experience of sculpture into a mediated "broadcast," it became a measure of obsolescence: the work has necessarily been updated several times with new technology as it migrated into different collections. In 1976, the collector São Schlumberger acquired *Oracle*; she then donated it to the Musée National d'Art Moderne. The work was to be shown in the inaugural presentation of the collection when the muse relocated in the new Centre Georges Pompidou in 1977. Klüver and Hodges redesigned the equipment so that the AM radios and DC motors could be moved out of the control console in the staircase and into each piece, eliminating the need to retransmit the control signals from the console.[53] They installed a "digital proportional remote radio control system" otherwise designed for use in remote-controlled hobby airplanes. Digital control signals for the volume and scanning rate were thus transmitted to servomotors (which could, in turn, transfer signals to the individual radios) in the other four pieces.[54] Upon arrival at the Pompidou, however, *Oracle* was forced to switch from the AM to the FM band, since the museum's metal structure acted as a "Faraday cage," blocking the interior from the AM range of frequencies.

The work has since required recurrent maintenance and renovation, including regular recharging of the batteries and repair of mechanical breakdowns.[55] In 1992, the Centre Georges Pompidou asked Klüver to repair *Oracle* for the museum's fifteenth anniversary. Working with Bruno Seeman, a physicist at the oilfield technologies company Schlumberger (the collector's family corporation), Klüver updated the work for the fourth time—using electronic (as opposed to motor-powered) scanning and wireless infrared transmitters.[56] Built into the very core of the work's structure, then, was the ultimate arbitrariness of obsolescence and technological change. *Oracle*'s future lay precisely in its degradation.

53. Klüver with Martin, 1991, p. 85-86.

54. *Ibid*.

55. Klüver, 1997, p. 69.

56. The electro-mechanical, motor-driven scanning had been the main source of power drainage. The new infrared transmitter system was of a type normally used for wireless earphones and advantageous because not subject to interference. Billy Klüver, 1994, p. 209. See also Rauschenberg, interview with Dorothy Gees Seckler, December 21, 1965, Tape 1.