Sound Maps and the Representation of Audible Space

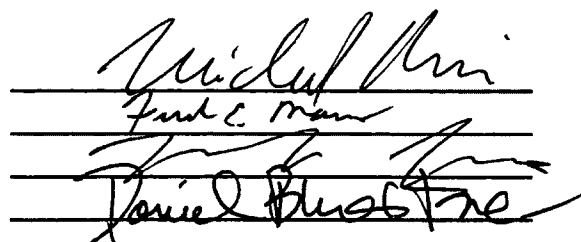Peter Louis Tschirhart
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Abstract

This dissertation constructs a critical and cultural history of the "sound map," a notational practice that can be defined in two ways: first, as diagrams, spatial graphics, or geophysical representations that adopt sound as their thematic object; second, as a way of thinking, a specifically sonic consciousness, that situates the interaction between sound and space as co-productive. Acting as a conceptual bridge, sound maps link the idea for a "soundscape" back to the complex realities of sound's transience: its weather-like properties, which make sound difficult to study and impossible to root. Each chapter links sound maps to a particular theoretical or cultural moment. The first locates the conceptual development of the sound map among the work of Harvard physicist Wallace Sabine, whose acoustical research yielded not only useful quantitative models, but provocative visual demonstrations of sound's tendency to change as it moves through and interacts with the physical environment. The second and third chapters conduct a critical analysis of urban and environmental sound maps —from the publications of the World Soundscape Project, to "Noise Exposure Maps" overseen by the Federal Aviation Administration. In addition to proposing a broad typology, these chapters work to disentangle the visual form of sound maps from the methodologies used to construct them. The fourth chapter studies how composers during the mid- and late-twentieth century utilize sound maps as a discrete notational element, one that opens new possibilites for creative action and embodied performance. The fifth chapter traces the influence of sound maps onto the work of utopian cyberneticist Nicolas Schöffer, whose provocative vision for the city of the future asks us to consider how sonic indeterminacies might be re-composed dynamically, and in real time, to make urban life sound more pleasing.

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Introduction

> It is the very structure of cartographic reason that—far from inscribing a single
> determinate line—draws and redraws our world, erases and inscribes again, decodes and
> recodes, in a ceaseless and complex array of forms of deterritorialization and
> reterritorialization producing the multiple and shifting identities (or assemblages) we take
> as ourselves.
> —John Pickles, *A History of Spaces*
>
> Put the tracings back into the map, connect the roots or trees back up with a rhizome.
> —Gilles Deleuze and Félix Guattari, *A Thousand Plateaus*

Scaping Sound

The goal of this dissertation is to sketch a critical and cultural history of the sound

map—a notational practice that developed alongside acoustical science at the end of the

19th century, and that proliferated throughout the arts, cultural geography, and urban

studies during the middle of the 20th. In the following chapters, I will scrutinize four

interrelated subjects: the advent of sound maps as a critical-theoretical practice; the use of

sound maps as a tool in environmental, cultural, and urban sound analysis; the

appearance of sound maps in musical notation and their reciprocal influence on the

perceived boundaries of notation as such; and the consequent utopian efforts to re-map

urban space as both a site and source of musical interest. To grasp why an analysis of

sound maps is needed, however, it is important to first understand something of the

historical and discursive context surrounding them.

Over the past 50 years, a growing chorus of scholars and artists has questioned how

sound intersects with everyday life. Of course, the very modality of that question—*how*

—suggests an underlying concern for methodology: the tools and assumptions we use to

develop answers will inevitably inform the kind of information we gather, the

conclusions we draw, and more importantly, the general nature of the interactions we

observe. And in fact, from Marxist theory to music, the methodologies used to-date have

proven quite diverse. Where spatial theorist Henri Lefebvre asked us to analyze the

"rhythms" of everyday life,[1] composer John Cage encouraged us to appreciate sounds

"just as they are, apart from psychology about them."[2]

Perhaps the most powerful and influential framing device to have developed,

though, is the idea that there exists a "scape" of sound—an equivalent to a "landscape" or

"streetscape"—some *thing* that can be studied aurally in the way others scapes are

studied visually and materially. The concept of "soundscape" was articulated with

particular clarity by the aptly named World Soundscape Project (WSP). At its height

during the 1970s, the WSP included a number of influential music, sound, and

communications scholars as members, including R. Murray Schafer, Barry Truax, and

Hildegard Westerkamp.[3] While their broad goal was to observe the balance among

human, animal, natural and mechanical sounds, an important premise of their work is that

many sounds—especially those of the factory, the car, and the airplane—have for decades

seeped unchecked into everyday life, the aural equivalent of industrial runoff and

chemical waste. In the process, these sounds have made scarce what the WSP called "hi-

[1] Henri Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life* (New York: Continuum International, 2004), 76-81.

[2] John Cage, *Silence* (Middletown, CT: Wesleyan University Press, 1939), 83.

[3] R. Murray Schafer, *The Tuning of the World,* New York: Knopf, 1977; Westerkamp in particular has recently been highlighted as the subject of a doctoral dissertation. See: Andrea Shirley Jean McCartney, *Sounding Places: Situated Conversations Through the Soundscape Compositions of Hildegard Westerkamp,* Ph.D. Diss, York University (Toronto, Ontario), 1999.; Truax, Acoustic Communication.

fi" listening environments,[4] places of relative quiet which allow us to hear and appreciate the intricate and easily masked sonic textures of more pleasant sounds, including those of chirping birds and rustling trees. Many of these same acoustic pollutants, they said, have also dirtied our "clean ears"—in part by creating a culture of omnipresent sound, where the whooshing of traffic or the "moozak" of shopping malls surrounds us constantly.[5]

Emerging at a time of great concern about industrial pollution, human health, and the future of Earth, it is difficult to view the WSP too far removed from the modern environmental movement. Rachel Carson's influential book *Silent Spring*, published in 1962, is commonly credited for being one (if not *the*) spark igniting the movement; and while there does not appear to be any direct connection between her ideas and WSP research—at least, none is directly credited—it is worth noting some of the philosophical and methodological synergies between them. One especially clear example can be seen in the title of Carson's book, which referenced the medium she believed would first alert us to impending environmental collapse:

> There was a strange stillness. The birds, for example—where had they gone? ... It was a spring without voices. On the mornings that had once throbbed with the dawn chorus of robins, catbirds, doves, jays, wrens, and scores of other bird voices there was now no sound; only silence lay over the fields and woods and marsh ... No

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[4] R. Murray Schafer, ed., *The Vancouver Soundscape* (Vancouver: A.R.C. Publications, 1978), 48; Schafer explains: "The hi-fi soundscape is one in which discrete sounds can be heard clearly because of the low ambient noise level. The country is generally more hi-fi than the city; night more than day; ancient more than modern .... The lo-fi soundscape results when accidental, trivial, or boring sounds are allowed to proliferate unchecked." (48)

[5] Ibid., 54. Schafer not only identifies omnipresent music as a problem, but suggests a solution: "Throughout history music has existed as figure—a desirable collection of sounds to which the listener gives special attention. Moozak reduces music to ground. It is a deliberate concession to lo-fi-ism. It multiplies sounds. It reduces a sacred art to a slobber. Moozak is music that is not to be listened to. By creating a fuss about sounds we snap them back into focus as figures. The way to defeat Moozak is, therefore, quite simple: listen to it." (54)

witchcraft, no enemy action had silenced the rebirth of new life in this stricken world. The people had done it themselves.[6]

Sound, or the lack of it, was for Carson the proverbial "canary in a coal mine"—the way we would finally come to realize we have passed the point of no return, the point at which the chemical sprays of modern agriculture and the mystery emissions of modern industry had yielded far more than record crop yields and consumer goods on a gigantic scale.

The shared sonic terminology here is deceptive, though, because there is a crucial distinction between how the WSP defines "silence" and how Carson does. For her, it is a natural (or rather, unnatural) silence that is to be feared, one where everything except humans has gone quiet. A silent world for Carson is a dead world, or one very near to it. But the WSP explains silence altogether differently. Their usual focus is "human silence"—the kind where cars, busses, and trucks disappear, leaving behind only the pre-industrial sounds of a world where people have a limited acoustical impact. Silence, from this point of view, is not to be totally avoided; in fact, it would be *necessary* for Carson's model of "listening for collapse" to ever work.

Other scholars during this period began from a different starting point but reached quite similar conclusions. For instance, during the mid 1960s, Michael Southworth and a small team of researchers at MIT undertook a survey of Boston.[7] Their "exploratory study" emerged from concern not about audible pollution as such, but rather the city's

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[6] Rachel Carson, *Silent Spring,* 40th Anniversary Edition (New York: Houghton Mifflin Harcourt, 2002), 2-3.

[7] Michael Southworth, "The Sonic Environment of Cities," *Environment and Behavior* 1, no. 1 (June 1969): 49-70.

aural structure, which they believed had become confused and distorted. Interesting is that Southworth's team approached this problem from what might be called a prototypical form of disability studies. "Blind persons," they wrote "rarely develop stable images of cities or other large and complex environments but at best have images of common trips."[8] The picture he paints is especially bleak for people who have suddenly become deaf: they risk living a life of "ceaseless pantomime," distanced and detached from the world, plagued by "depression ... feelings of loss, lack of alertness, sadness, loneliness, and paranoid tendencies."[9] As a "link to reality," sound allows people to grasp how the city functions, how different neighborhoods and areas are stitched together.[10] So to analyze this web of relations, Southworth's team enrolled willing participants in a wheelchair tour of the city of Boston. Their goal was to observe how sound influences our sense of place, how it gives shape to the environment as we experience it. Paying more attention to these considerations, they suggested, "would not only enhance city life by helping to overcome the stress and anonymity of today's visual city, but would be one measure for developing the sensory awareness of city residents and would provide an environment more responsive to human action and purpose."[11]

Many principles of "soundscape" analysis have since been adopted by scholars in other fields. Following closely on WSP ideals, anthropologist Steven Feld approached his work with the Bosavi people in Papua New Guinea with a decidedly aural focus. In

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[8] Ibid., 50.

[9] Ibid., 51.

[10] Ibid., 52.

[11] Ibid., 70.

studying "sound as a cultural system," the aim of his influential book *Sound and Sentiment* was to show how "modes and codes of sound" can lead us to a greater understanding not only of a society's internal or political structure, but of the quality of life its people experience.[12] During the early 2000s, Feld developed his work into a number of CD releases, which function, as Sarah Pink has written, "as invitations to listen in a particular embodied way ... [offering] listeners a route through which to hear as others might."[13]

Sound Fixed and Unfixed

Not all scholars have jumped on the bandwagon of soundscape analysis or soundscape composition—or even agree such a thing as a "soundscape" exists. In 2007, British anthropologist Tim Ingold penned a clear and compelling essay expressing his belief that the attempt to "scape" sound is altogether problematic. To scape, he writes, is to make stable; and this makes the notion of a soundscape inherently incompatible with sound, which "is neither mental nor material, but a phenomenon of *experience,* that is, of our immersion in, and commingling with, the world in which we find ourselves."[14] From Ingold's point of view, it is wrong to suppose "that the power of hearing inheres in recordings."[15] Sound cannot be subject to taxidermy: it cannot simply be extracted from the field, removed from active engagement, understood in the abstract "head space" of

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[12] Steven Feld, *Sound and Sentiment: Birds, Weeping, Poetics, and Song in Kaluli Expression* (Philadelphia: University of Pennsylvania Press, 1990), 3.

[13] Sarah Pink, *Doing Sensory Ethnography* (Los Angeles and London: Sage, 2009), 143.

[14] Tim Ingold, "Against Soundscape," in *Autumn Leaves: Sound and the Environment in Artistic Practice,* ed. Angus Carlyle, (Paris: Double Entendre, 2007), 11.

[15] Ibid., 11.

another person while maintaining cohesion. Neither is sound a thing, strictly speaking: it is compression waves moving through air. As a result, Ingold argues, we should not think of sound as something *that* we hear; instead, we should think of it as a medium we *hear in.* He writes:

> Sound flows, as wind blows, along irregular, winding paths, and the places it describes are like eddies, formed by a circular movement around rather than a fixed location within. To follow sound, that is to listen, is to wander the same paths. Attentive listening, as opposed to passive hearing, surely entails the very opposite of emplacement. We may, in practice be anchored to the ground, but it is not sound that provides the anchor ... the sweep of sound continually endeavors to tear listeners away, causing them to surrender to its movement. It requires effort to stay in place. And this effort pulls against sound rather than harmonizing with it. Place confinement, in short, is a form of deafness.[16]

The ultimate risk is in positing the existence of an audible space that is falsely tangible, one where "persons and objects [have been] already precipitated out, or solidified, from these fluxes."[17] Even still, Ingold argues most anthropologists and sound scholars today remain focused on what is stable about sound, the "fixities of surface conformation," rather than its changes, "the fluxes of the medium."[18]

An alternative, he suggests, is to think of sound as always-already in motion, as a phenomenon that cannot possibly be rooted. Rather than vision and sight, a better analogy for sound he suggests can be found with weather: "[w]e do not touch the wind," he writes, "but touch in it; we do not see sunshine, but see in it; we do not hear rain, but hear in it."[19] Sound, from this point of view, must not be reified. While certainly temporal, sound only becomes audible before quickly fading; while certainly structural,

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[16] Ibid., 12.

[17] Ibid.

[18] Ibid.

[19] Ibid.

its exact form slips away before it can be fixed. Because sound is difficult to "scape,"

Ingold explains, "our metaphors for describing auditory space ... should be derived not

from landscape studies but from meteorology."[20]

While the sudden rise in soundscape research on its own might present reasonable

cause for concern, Ingold's critique is arguably unfair, since some parts of this

scholarship already does what he proposes: to treat sound as a kind of weather. Indeed, a

"minor" practice visible even among WSP scholarship is maps meant to place sound

among a constantly shifting field of audition, of culture, of weather—all designed to

show movement, change, and evolution.[21] These maps *show* sound as well as any weather

map can: as a phenomenon passing through a city, noticed or unnoticed. Sound, through a

kind of metaphorical exchange, becomes visible as lines, dots, scribbles, or icons: present

visually, but not audibly.

As Valérie Maffiolo has written, maps of sound have clear methodological

advantages. Unlike recordings, which risk essentializing a journey through sound

technologically, the "graphic mode" she writes, "allows us to stress the diversity of levels

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[20] Ibid.

[21] The "minor" as I use it here is a concept developed by Gilles Deleuze and Félix Guattari to describe the transfer of power back-and-forth among symbolic forms of authority, including language and other representational systems. As Verena Conley explains, Deleuze's argument, which is commonly used by postcolonial theorists, is that "we need to distinguish between major and minor language, that is, between a power (*pouvoir*) of constants and a power (*puissance*) of variables. In the political sphere where a 'major' language is seen and heard, there also inheres in its form a 'minor' element that does not exist independently or outside of its expression and statements. The more a language has or acquires the characteristics of a major form, the more likely it is to be affected by continuous variations that can transpose it into a minor language." (Verena Conley, "Minoritarian," in *The Deleuze Dictionary,* ed. Adrian Parr [Edinburgh: Edinburgh University Press, 2005], 164.) The concept of the "minor" has resonance here because of the way sound maps act within the dominant discourse of soundscapes. See also: Gilles Deleuze and Félix Guattari, *Kafka: Toward a Minor Literature,* trans. Dana Polan (Minneapolis: University of Minnesota Press, 1986).

of abstraction for sound representations in human memory."[22] Maps, though, are not just useful in showing what people perceive or recall from past experience. They can also be used to track and locate sound empirically, much as weather maps track the approach of cold fronts and storm cells. This has been proven especially appealing to scholars seeking to study how sound shapes the formation of community identity. Moreover, as Olivier Balaÿ has written, "ready-made" maps, including those backed by interactive GIS software, could become a site of interactive place-based engagement with sound. Drawing on his work at the Centre de recherche sur l'espace sonore et l'environnement urbain (CRESSON), Balaÿ argues sound maps, much like online weather maps, could provide "new ways of exploring and organising auditory journeys for its users."[23]

Maps and mappings have emerged, if not as an alternative to film- or recording-based analysis, then certainly as a way to supplement it. But perhaps also, and more importantly, they stand to enrich the continued development of critical spatial theory. As Edward Soja has explained, the failure of Marxist theory to fully develop a broad theory of space can be understood as a failure to appreciate how "[t]he structure of organized space is not a separate structure with its own autonomous laws of construction and transformation, nor is it simply an expression of the class structures emerging from the social ... relations of production."[24] Where theorists including Lefebvre and David Harvey have sought causal relationships—whether the production of space drives

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[22] Valérie Maffiolo, et al, "Sound Characterization of Urban Environment," *Inter-noise* 3 (1997), 1242.

[23] Olivier Balaÿ, "Discrete mapping of urban soundscapes," translated by Harry Forster, *Soundscape: The Journal of Acoustic Ecology* 5, no. 1 (Spring/Summer 2004): 14.

[24] Edward Soja, "The Socio-Spatial Dialectic," *Annals of the Association of American Geographers* 70, no. 2 (June 1980), 208.

economic relations (or vice versa), and furthermore, whether that relationship manifests in the physical structure of the city—Soja proposes something more extensive. He writes, "the two sets of relations are not only homologous, in that they arise from the same origins in the mode of production, but also dialectically intertwined and inseparable."[25]

The appearance of sound as a domain of inquiry, and sound maps as a modality of inquiry, suggests further ways to enrich the development of Marxist spatial discourse. Attempts to link sound with participatory action mean what Soja has sketched as a social-spatial dialectic might be expanded with a third term: social-sonic-spatial. In the same way "the urban" is homologous with relations of production, it may well be that sound is, too. Like tracking "economic weather," sound maps could be used to facilitate this kind of critique: tracing fluctuations in sound, linking them to the activities and behaviors of everyday life, connecting them back to economic and state interests. They could furthermore add a potentially complementary trajectory to the study of power, one that can enrich (when not more simply complicate) our understanding of the political economy.[26]

Exchanging Metaphors

An obvious question remains why a music scholar would be interested or qualified to analyze sound maps—not only their visual aspects, but the power operations they conceal. Apart from the obvious involvement of sound, and in some cases the organization of sound—both of which are particular areas of expertise for musicians—a more specific answer is that the kind of metaphorical exchange sound maps perform—the

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[25] Ibid., 209.

[26] Some of these issues will be addressed in Chapter 3 of this dissertation.

transformation of lines, dots, fields, arrows, gradients, and numbers into representations of sound, action, direction, and movement—is one that scholars of notation are already familiar with. Similar exchanges are common among works of music and performance art from the mid 20th century. In many of them, artists challenge not only what a symbol means, but how and on what terms the notation implicates sound in the first place.

This kind of exchange is modeled with particular clarity in two works. One is *Composition 1960, #10 by* american composer La Monte Young. The score itself consists of nothing more than a simple, unadorned text: "Draw a straight line and follow it." The use of a simple, enigmatic text as a performance instruction was, of course, commonplace among experimental art and music during the 1960s and 70s—especially among a casual group of artists associated with Fluxus, including George Maciunas, Ben Patterson, Alison Knowles, Dick Higgins, and others. Playing with language, as Young does here, raises important questions about the relationship between text, score, and implied action, questions, ultimately, about the capacity of language to function instrumentally. As art historian Liz Kotz has argued, works like *#10* suggest the appearance of an "alternate poetics," one that "[emerged] in the postwar era as a counter-model to the earlier avant-garde practices of asyntacticality, musicality, and semiotic disruption."[27]

If this alternate poetics can be understood as an attempt at counterposing the deconstructionist idea of the text as performative, *#10* takes a step back from the precipice of disintegrating language and, instead, asks us to view the instructions naively: first, as simply what they are and what they say; and second, as the object of exploration,

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[27] Liz Kotz, *Words to Be Looked At: Language in 1960s Art* (Cambridge, MA: The MIT Press, 2007), 64.

not merely performance. But it is at this point—where language seems momentarily to reacquire meaning and become actionable, where poetic simplicity becomes its most disruptive—complexity and contradiction return. Whatever clarity there was in the beginning evaporates quickly once words become not just objects of contemplation but of performance. Beginning the process requires us to approach the line as fundamentally relational—much as Ingold has written: "any history of the line has to start with the relations between lines and surfaces."[28]

Young's text asks us not only to read between the line, as it were, but in a literal sense to question the ontology of line-ness. What is the relationship between a drawn line and the act of following it? What line? How can it be "followed?" One paradoxical possibility Young's piece suggests is that, by trying to draw a straight line, we find we cannot: we can only produced curved, wiggly, or disjointed lines. But even if we accept the idea of a compromise, of drawing a "relatively straight line," there remains the problem of how to "follow" it. Also possible, perhaps even likely, is that we might "draw" a line entirely in the metaphorical sense—as in the colloquial expression to make a "bee-line." And this suggests another possible paradox: we draw the line by following it *first*. The line becomes, almost immediately, a representation of something else: the representation of a path already walked.

It is here that a second work becomes important. Among the voluminous score for *Song Books* by John Cage are three relevant songs: numbers 3, 4, and 25.[29] In each of

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[28] Ingold, *Against Soundscape,* 38.

[29] John Cage, *Song Books, Volume I: Solos for Voice: 3-58* (New York and London: C.F. Peters, 1970).

these pieces, the performer is instructed to travel a map of Concord, Massachusetts by drawing an uninterrupted line between two points. (Figure 0-1) While the starting and ending points are determined in advance by the I-Ching, and further written into the instructions, the indeterminate route between them must conform to the shape, contour, and limitations of the represented space: foot paths, bridges, walkways, and so on. In "Solo No. 3," for instance, Cage instructs: "[g]o from Fair Haven Hill down the river by boat and then inland to the house beyond Blood's. Turn the map so that the path you take suggests a melodic line."[30]

Somewhat like *#10*, the line here appears first as a site and object of a performance, since in Cage's instructions, drawing it becomes equivalent to actually traveling a path. But, in being traveled, the path acquires another layer of meaning: it becomes a continuous melodic glissando, whose cartographically determined twists and turns imply changes in pitch, and whose length implies general duration. The line is not only "followed" in a more standardly "musical" sense, but in fact is connected to indeterminate movement and (relatively) indeterminate pitch. The line and map together function doubly: as already-sonic representations of space-as-sound; and conversely, as already-spatial representations of sound-as-movement.

Cage's songs and map of Concord make literal what in Young's enigmatic instructions is merely implied. That is to say, if in *#10* the line becomes the performance, in Cage's *Song Book,* the map becomes a site where lines acquire specific spatial and sonic meaning. Indeed, in a more conventional sense, if lines are not thought to be

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[30] Ibid., 2.

performative, and if cartographic space is presumed to be silent, then these two works together challenge our assumptions about both drawing and cartography. Together, they encourage us not simply to locate sound by "tracing" it, but to view those tracings as themselves performing sound; they ask us to rethink not just the nature of the line, but to reconsider as already-musical the space it is drawn through. And as the "glue" in these visual and sonic metaphors becomes unstuck, they make conceptual space for the analysis not only of the superficial structure and technical operations of notation, but the relational implications beneath the surface.

While the notion of a "musical line" itself has a complex history, and in fact Ingold himself has written on the subject,[31] lines here become not just the object and medium of notation, but metaphorical lines of demarcation: signaling the point at which the surface of the map becomes sonically "charged," the moment when graphical marks—dots, dashes, icons, symbols, speckles, or flags embedded on a digital surface—acquire specifically sonic implication. Context is everything; and despite what we might be tempted to think simply by looking at them, no such notational construct is ever entirely innocent—they conceal almost by design the choices that were made about their construction. The need for critique therefore appears with special urgency.

Plan of the Current Work

Jacqueline Waldock has recently described sound maps as "a new interactive, publicly engaging medium," one that "has emerged in sonic studies over the last decade" while capturing "the imagination of acoustic societies, libraries, universities, and tourist

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[31] Tim Ingold, *Lines: A Brief History* (London and New York: Routledge, 2007), 18-24.

organisations alike."[32] Similarly, Balaÿ observed in the journal *Soundscape* that "[n]ever before have we devoted so much energy to mapping physical measurements of urban sound environments."[33] Against the grain, one overarching claim of this dissertation is that sound maps are not "new" in either conception or practice; and moreover, as the work of Maffiolo and others have suggested, their usefulness is not limited simply to the representation of physical sound measurements. Indeed, while sound maps have great promise as an analytical tool, they can also be found today in a number of diverse contexts, including subjective sound surveys, online crowd sourcing projects, and even visual art. Inadvertently but necessarily, however, sound maps function also as instruments of power, capable of advancing discourse or closing it off. This dissertation aims, therefore, to study sound maps as objects and tools of power, as a creative and potentially worrisome form of notation.

In Chapter one, I locate the conceptual emergence of the sound map among the work of acoustics pioneer Wallace Sabine. His work at Harvard University at the turn of the 20th century is often thought to mark the foundational moment for modern acoustical science. This well-known story takes as its starting point the discovery of scientific formulas capable of predicting and controlling certain "spatial" properties of sound, like reverberation; but in doing so, this genealogy encourages us to overlook a counterbalancing development: maps and diagrams that, far from showing space as stable

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[32] Jacqueline Waldock, "Soundmapping: Critiques and Reflections on this New Publicly Engaging Medium," *Journal of Sonic Studies* 1, no. 1 (October 2011), http://journal.sonicstudies.org/vol01/nr01/a08 (accessed 23 April 2012), np.

[33] Balaÿ, "Discrete mapping," 13.

and unchanging, depict sonic environments as fluid and inconsistent, changing from moment to moment and place to place.

In concept, sound maps appear among Sabine's work as photographs and other novel diagrams showing the fluctuation and movement of sound even within a highly controlled laboratory setting. And because these images emerge alongside acoustical science as it is traditionally understood, I suggest they perform a needed act of critique by making difficult the desire to control space, to render it homogeneous and stable. These images, I suggest, more accurately follow a model proposed by Fredric Jameson (the "cognitive" map) and Gilles Deleuze and Félix Guattari (the map as "rhizome"). From these maps, a kind of critical-dialectical practice emerges from within the very heart of scientific efforts to manipulate the environment as stable; and in chasing what I call the "sonic Real," they make other incarnations of the sound map conceptually possible.

In the second chapter, I study sound maps as they are used in environmental and urban sound studies: from the World Soundscape Project, to digital/online collaborative sound maps, and government sound surveys. But it is crucial not to be distracted by surface appearance. As historians like Brian Harley and John Pickles have explained, maps are never what they appear to be. Like other kinds of "thematic cartography," constructing a sound map necessarily involves making careful decisions about what to show and how to show it. Consequently, the bulk of Chapter 2 is dedicated to sketching a broad sound map typology. Although some general similarities exist between them, I propose that five types can be identified, defined according to a mixture of visual, technical, sonic, and methodological details: grid maps are defined by their visual texture;

field maps can be distinguished by reflecting sites of sonic interest to a community; soundwalk maps guide us between or among specific sounds, much like musical notation; territory maps acquire instrumental and regulatory functions; dynamic maps become objects of community engagement at the (sometimes high) price of a confused and complicated ontology of sound.

While parsing each type necessarily involves highlighting salient features, then connecting them back to actual practice, I continue in Chapter 3 by conducting a brief case study of one particular sound map: a "territory" map, called Part 150 "Noise Exposure Maps" (NEMs), made through a voluntary noise program managed by the Federal Aviation Administration. Quite apart from the emancipatory rhetoric often surrounding sound maps, these maps in particular provide some cause for concern. I draw on the recent work of Michael Hardt and Antonio Negri to argue that, by serving as instruments of political authority, and through their interactions with the neoliberal economy, NEMs perform an act of "positive" enclosure—bracketing sound, placing it off limits—by dictating which sounds people must be willing to tolerate, and at what price.

In Chapter 4, I locate sound maps in creative and artistic practice, where they are used as a form of music notation. Unlike Cage and Young, whose works merely model the exchange and recombination of spatial and sonic metaphors, in this chapter, I explore compositions where sound maps are written-in to the score. I suggest this becomes visible in two contexts: first, in musical compositions supplemented by work-specific spatial graphics; second, in music where all aspects of conventional notation are abandoned,

replaced by maps, photographs, or collages that seem otherwise hardly related to the production of sound or music at all.

Indeed, while there is nothing particularly unusual about a simple staging diagram, I argue here that sound maps are neither simple nor staging diagrams *as such*. More like older forms of so-called spatial music, including polyphonic choral music, these diagrams are designed to implicate space to produce selective effects. Unlike earlier forms, however, sound maps are quite explicit in how spatial indeterminacies are to be used: where the polyphonic works of Telemann leave space unnotated, the scores discussed in this chapter often leave no contingency unplanned, and yet, they hold short of becoming "universal" or "universalizing." Finally, while the spatial and representational mechanisms used in these works often resemble those of other place-based sound and performance artists—including Richard Long, Max Neuhaus, or even Guy Debord—I suggest sound maps are significant for being both explicitly spatial and focused openly on the production, audition, or movement of the performer through sound.

In Chapter 5, I again pick up the thread of environmental sound mapping, except this time, I connect it to a looming problem soundscape scholars have so far dealt with unsuccessfully: how to design the sounds of everyday life. I turn here in particular to the work of utopian cyberneticist and sculptor Nicolas Schöffer, who presented a thorough and ambitious plan in his 1969 book *La Ville Cybernétique*. Returning a sense of consistency and clarity to the city, he believed, would require implementing five topologies, one of which, sound, entailed broadcasting dynamically-processed *musique concrète* from giant cybernetic towers. In Schöffer's work, the city itself becomes the site

and source of a large, interactive, and indeterminate musical composition. While Schöffer's work is often discussed in literature on sculpture and architecture, his ambitious proposal to re-map the city sonically has yet to be analyzed by scholars in either music or sound studies. In this chapter, then, I not only explain how Schöffer understood sound and planned to make use of it, but why he thought re-imagining the urban environment was necessary to begin with. I conclude by locating *La Ville Cybernétique* among extant critical literature, which, though dismissive, often fails to consider its positive philosophical and practical dimensions. I also briefly highlight how Schöffer's vision conforms to what theorist Jacques Attali called the "future of music:" a collaborative process of community music making he called "composing."

Acting as a conceptual bridge, sound maps link the idea for a "soundscape" back to the complex realities of sound's transience: its weather-like properties, which make sound difficult to study and impossible to root. As contemporary research grapples with questions no single discipline can answer alone, I believe sound maps in their many varieties will continue to emerge both as useful tools in our interdisciplinary toolbox, and as insightful subjects for critical and cultural analysis. While much remains to be written on the subject of sound maps, I hope this dissertation will open fruitful new areas of collaborative inquiry—especially for scholars working in music, sound studies, the digital humanities, urban studies, cultural geography, and sound art.

Chapter 1: Theorizing the Sound Map

> The map is open and connectable in all its dimensions; it is detachable, reversible, susceptible to constant modification. It can be torn, reversed, adapted to any kind of mounting, reworked by an individual, group, or social formation. It can be drawn on a wall, conceived of as a work of art, constructed as a political action or as a mediation.
> —Gilles Deleuze and Félix Guattari, *A Thousand Plateaus*

Introduction

Given the relatively unfamiliar subject of this dissertation, it seems appropriate to begin with a definition. Sound maps are spatial diagrams or cartographic representations that adopt sound as their thematic object. How exactly this theme manifests—for instance, the kind, type, quality, or moment of sound the maps show—varies greatly depending on context and use; and indeed, disentangling this complexity will become a central focus of later chapters. But it is important to realize that sound maps are not just visual objects. They also, and perhaps more significantly, exemplify a certain way of thinking about the world, a way that gestures toward bridging material and experiential forms of analysis. This conceptual groundwork is important for understanding the more practical and tangible aspects of sound maps; and for that reason, I wish to begin this dissertation by addressing questions of thought, culture, and theory: How do we *think* about the relationship between sound and space?

To search for an answer, I will turn first to the development of acoustical science. Extant historical literature paints a predictable picture: sound appeared first as a mysterious and slippery object of analysis, a seemingly amorphous non-thing, which, to be understood, had to be quantified and transformed into general principles and stable laws. This narrative is crystalized in the familiar work of Wallace Sabine, whose research at Harvard University during the late 19th and early 20th centuries is often thought to mark

the foundation of modern acoustical science—the moment when, as Emily Thompson has written, the "soundscape of modernity" was born.[1] I will therefore begin by narrating this story, except with an important difference. Here, I draw Sabine's work into dialogue with earlier research on sound and acoustics. My goal is to explain how his experiments, as they are understood today, can be said to draw on the Cartesian matrix of "matter and motion." Although a detailed critique of this idealogical, historical, and scientific complex deserves to be fully mounted, what I suggest warrants specific scrutiny here is not Sabine's empirical methodology, or indeed his specific conclusions, but rather the underlying cultural and environmental impulses it articulates: the desire both to exert mastery over the environment and to discipline the bodies inhabiting it.

I continue by proposing an alternate sonic consciousness, a different way to think about the relationship between sound and space, one comparably less concerned with exerting control. I do this, however, by returning to Sabine's work, by re-reading it, paying special attention to a series of visual diagrams scattered throughout his collected papers—images I call "sound maps." While seldom discussed and usually treated as self-explanatory, a closer analysis highlights the important way these diagrams differ from other, more idealized and idealizing forms of analysis. In showing a complex, temporally constrained, and otherwise "messy" reality, sound maps empower us to study and appreciate the aural environment without the corresponding need to fabricate what Fredric Jameson calls a "totalizing discourse."

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[1] Emily Thompson, *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933* (Cambridge, MA: MIT Press, 2002), 107-13.

It is important also to be aware of the way sound maps function: theoretically how, and philosophically why, they perform such a vital, if under-appreciated role in the study of the audible everyday. As I will suggest, sound maps are difficult to describe and explain, at least initially, because of our tendency to seek absolutes. I will therefore turn briefly to the ontology of Gilles Deleuze, whose notion of "univocity" provides a way for us to think about ordinary experience as singular and yet highly textured. That is to say, rather than being strictly physical—a (abstract) space into which (an abstract notion of) sound is later injected—sound maps allow us to analyze the environment as already and richly filled with sound. As hybrid visual-sonic representations, they encourage us to embrace this apparent messiness rather than flatten, simplify, or overgeneralize it.

In the end, I address a looming question: What is to stop sound maps from becoming precisely the form of "ideal discourse" I have suggested they resist? To answer, I explain how sound maps function as part of what Lacan called the Symbolic-Real. These images are inherently impossible to complete—technically, physically, acoustically, and representationally. There are simply too many variables and too many contingencies that would change, in a meaningful way, what the map is designed to show. As a result, the final image we call "a map" becomes the implicit object of repetition; and at that very moment, the map is itself transformed: from an object of vision, to an object of desire. As common, familiar, or self-explanatory as they may seem, sound maps bring not just a new awareness of the world, but a new *kind* of awareness—one where complexity, rather than stability, where maps and mappings, rather than laws and truths, emerge as a legitimate area of interest.

Part I: From Speculation to Certainty

In 1895, Wallace Sabine was contacted by Charles Eliot, the President of the Corporation of Harvard University. As a physics professor, Sabine was asked to apply his knowledge of electricity and the properties of electromagnetic waves to a somewhat more tangible problem.[2] A lecture hall inside the newly completed Fogg Art Museum was thought to be far too resonant for ordinary usage, distorting the spoken word to the point of unintelligibility. Sabine was therefore asked to analyze the space while holding three specific tasks in mind: the first was to uncover the material and acoustical faults of the hall itself; the second was to devise an effective strategy to remedy these faults; the third, and most challenging, was to develop general principles that could be used to assess and evaluate other spaces, and to prevent similarly unwanted outcomes in the future.[3]

As straightforward as these tasks might seem, there was no existing methodology, no research procedure, and no general principles of acoustics on which Sabine could rely. Indeed, the extent to which acoustical science lagged behind other fields of inquiry is perhaps surprising. Even at the turn of the 20th century, long after comparable laws of gravity and electricity had been established, sound remained a slippery and difficult object of study. Beliefs about sound—what it was, how it moved and behaved, the way it managed to stir the passions—remained rooted in an almost anxious uncertainty, and it was certainly not unusual to find apparently sober acoustical wisdom tinged with mysticism. A common belief during the end of the 19th century, for instance, was that

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[2] Wallace Sabine, *Collected Papers on Acoustics* (Cambridge, MA: Harvard University Press, 1922), 3.

[3] Ibid., 34.

twice-built blueprints would yield spaces with different acoustical profiles.[4] Retrofits

were likewise dubious. One frequent fix entailed suspending long lengths of metal wire

parallel to the floor, just below the ceiling.[5] (Figure 1-1) The wire, it was believed, would

absorb excess vibrations sympathetically, thereby mitigating excessive reverberation.[6]

Other remedies were meant to have the opposite effect. It was thought, for example, that

placing vases of different sizes and shapes throughout a room would help to make it more

resonant—a solution, which, Sabine writes, was "wrongly supposed to have been the

object of the vases in Greek theatres."[7]

The uncertainty surrounding acoustics was by no means new, however, and in fact

could be said to have quite deep historical roots. As far back as the 16th century, sound

research often seemed to be balanced precariously between the domains of the natural

and the supernatural, and only seldom could any distinction be drawn between

speculative and *operative* modes of inquiry. Where, as science historian Penelope Gouk

has explained, the "speculative side is concerned with the underlying causes of things and

providing explanations for particular phenomena," the operative is more concerned with

expanding the bounds of human understanding, demystifying the nature of universal

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[4] Ibid., 62. Sabine dispatches this myth quickly:

> *The oft-repeated statement that a copy of an auditorium does not necessarily possess the same acoustical qualities is not justified, and invests the subject with an unwarranted mysticism. The fact is that exact copies have rarely been made and can hardly be expected ... Our increasing demands in regard to heat and ventilation, the restriction of the dimensions enforced by location, the changes in size imposed by the demands for seating capacity, have prevented, in different degrees, copies from being copies, and models from successfully serving as models.*

[5] Ibid., 4, 132.

[6] Ibid., 4.

[7] Ibid., 4.

truths, perhaps even decoding the mind of an all-knowing and rational creator.[8] Indeed,

scientific investigations during this period often more closely resembled magic shows

than careful and controlled laboratory experiments. Francis Bacon, for one, "proposed a

whole series of experiments to see how the materials used in the construction of

instruments ... determined qualities such as pitch and timbre." Moreover, his

observational reports, though quite detailed, often touch on the occult.[9] In his book *Sylva,*

which contains some of his most important work on sound and hearing, Bacon explained

how

> if a Lute, or Viall, bee layed uppn the back with a small Straw upon one of the
> Strings; and another Lute or Viall bee laid by it; And in the other Lute or Viall, the
> Unison to that String bee strucken; it will make the String move...[10]

In Bacon's estimation, the most "interesting types of sound were those which seemed

marvelous or unusual"—those which seemed to defy immediate explanation, or which

were too cumbersome or impossible to subject to staged investigation.[11] This category

included a number of otherwise spatial and architectural sound effects, such as strange

echos resulting from peculiar geological formations. It also included

> a church at Gloucester where 'if you speak against a Wall, softly, another shall hear
> your *Voice* better a good Way off, than neere hand,' a phenomenon which Bacon
> though merited further enquiry.[12]

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[8] Penelope Gouk, *Music, Science and Natural Magic in Seventeenth-Century England* (New Haven and London: Yale University Press, 1999), 93.

[9] Francis Bacon, *Sylva,* quoted in Gouk, *Music, Science, and Natural Magic,* 169.

[10] Ibid., 169.

[11] Gouk, *Music, Science, and Natural Magic,* 161.

[12] Bacon, quoted in Gouk, *Music, Science and Natural Magic,* 161-62.

Public demonstrations, too, had more than purely scientific aims; they also played an

important social and cultural role. In making the quirks of the natural world not only

visible but, at times, audible, they helped generate common enthusiasm for the very field

of empirical inquiry that scientists themselves hoped to advance.

Making Math Work

There nonetheless remained several important barriers to acoustical research.

Foremost among them was how to mediate experimental results. Despite that most aural

phenomena "could not be quantified or expressed in mathematical formulae, and even

those that seemed amenable to this process were still far from being fully understood,"[13]

mathematics still offered the most promising path forward. It was appealing primarily

because of the way it functioned as an abstract instrument—one that, much like Bacon's

lutes and viols, occupied

> an intermediary position between knowledge of natural things, which rely on sense
> perception and conjecture, and knowledge of supernatural things, which are
> apprehended directly by the mind and produce certainty.[14]

Math, in that sense, was a somewhat modest tool that could be used to expose sound's

tricks—to disempower it, even if only momentarily, so that the "strange participation

among things" could be unearthed.[15] To some scientists, however, math was thought to

conceal a much deeper truth, one articulated by John Dee as early as 1570: that nature

was itself regular and predictable. Following from this, as Gouk explains, math could

function as an "intermediary" discipline operating "between the material and intellectual

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[13] Gouk, *Music, Science, and Natural Magic,* 158.

[14] Ibid., 86.

[15] Ibid., 86-87.

realms"[16]—not only because math, itself, is internally coherent, but because beneath the

observable surface, nature is constructed similarly. The underlying premises here—that

sound can be accurately quantified, and that it behaves according to immutable,

mathematical laws—consequently entail seeking vicarious access to something else,

something more profound: a cosmic fabric whose threads were woven together in a

regular and predictable way.

Indeed, as science philosopher Ronald Giere has written, it was widely believed

that mathematics and similar rational systems were capable not only of exposing the

hidden threads of the universe, but of granting us access to the loom. He explains:

> The notion of a law of nature did not arise out of the practice of science itself.
> Sometime in the seventeenth century, it was imported into discourse about science
> from Christian theology, both directly, and indirectly through mathematics. Originally,
> laws of nature were understood as God's laws for nature. Thus, behind the laws of
> nature was a lawgiver, from whence came the universality and necessity of such
> laws. It is still common for scientists and commentators on science to speak of nature
> as being 'governed' by laws of nature, which suggest that somewhere there might be
> a 'governor.' It also seems pretty clear that this theological notion of laws of nature
> became prominent through the writings of Descartes.[17]

The notion of a rational and stable universe was indeed powerful and attractive. And as

Giere suggests, it was taken in a new direction beginning in the mid 17th century, when

René Descartes presented his argument that the universe could be understood "as a

plenum filled with infinitely divisible matter, which was effectively made up of three

types."[18] Gouk clarifies:

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[16] Ibid., 86, 88.

[17] Ronald Giere, *Scientific Perspectivism* (Chicago: University of Chicago Press, 2006), 70.

[18] Penelope Gouk, "Some English Theories of Hearing in the Seventeenth Century Before and
After Descartes," in *The Second Sense: Studies in Hearing and Musical Judgement from
Antiquity to the Seventeenth Century,* eds. Charles Burnett, Michael Fend, and Penelope Gouk
(London: The Warburg Institute, University of London, 1991), 104.

> The first of these comprised large, irregular particles of 'gross matter' which formed solid bodies; the second consisted of smaller but still coarse spherical particles of air (which provided, among other things, the medium of sound); the third was made up of extremely fine particles which filled the spaces between the first and second types and was called 'subtle matter.'[19]

This tripartite division provided a fundamental framework for analyzing the world as though it were configured mechanically. And indeed, the harmony Descartes observed among different materials suggested that sound, too, could be understood in terms both physical and physiological: as a series of vibrations, proceeding through one kind of matter to the next, from a vibrating string, through "subtle matter," until it influences human nerves.[20] As Descartes saw it, this was a purely material relationship whose corresponding machinations were observable, measurable, and very probably controllable.

This belief consequently gave renewed importance to the study of "musical sound," which, as Gouk writes, "seemed to provide a perfect demonstration of the real, *mathematical* correspondence between the external world of particulate motion and the mind, which can grasp abstract relationships."[21] Much more than a useful and helpful way to explain the world, math, it seemed, *was* the way in which nature operated—it was *how* the world was knit together. Expressing sound and music mathematically—as simply and elegantly as possible—was tantamount to exposing the inner workings of the universe on its own terms. The power of this idea, what is called "Cartesian synthesis," was its palpable totality.[22] As Gouk writes, "it explained everything at once—in

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[19] Ibid., 104.

[20] Ibid., 105.

[21] Ibid., 106.

[22] Ibid., 106.

twentieth-century terms, it was a 'grand unified theory."[23] Although it was not without its

detractors, the underlying idea was, in the end, so compelling that even people who

disagreed with various details "accepted its fundamental premise that matter and motion

are the basis of explanation."[24] The rise to prominence of a mathematical and mechanistic

world view was in itself an important indicator of the way in which we, as a society,

would come to understand the world. It simultaneously set a standard for how future

scientific observations would be expressed: by the numbers.

By the end end of the 19th century, increasingly throughout the 20th, and well into

the 21st, mathematical and quantitative explanations are valued because of their

tantalizing promise of completeness.[25] But, in the process of establishing empirical

hegemony, the opposite has also been widely accepted: that anything can be expressed

mathematically, because everything contains math—from particle physics to modern

manufacturing techniques; from voting behavior to the logic of consumer demand; from

Einstein's General Theory of Relativity to Corbusier's "Modulor."

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[23] Ibid., 106.

[24] Ibid., 106-109. Gouk names Kenelm Digby, Robert Hooke, and Thomas Willis.

[25] Examples can be found even in "popular" science literature. A book recently published by Cambridge physicist Stephen Hawking contains an entire chapter dedicated to "The Theory of Everything." It begins by explaining that "[t]he universe is comprehensible because it is governed by scientific laws; that is to say, its behavior can be modeled." (87) After a broad overview of scientific theories developed over the past several hundred years, it concludes with a significant hedge on the initial claim:

> Then came quantum uncertainty, curved space, quarks, strings, and extra dimensions, and the net result of their labor is 10^{500} universes, each with different laws, only one of which corresponds to the universe as we know it. The original hope of physicists to produce a single theory explaining the apparent laws of our universe as the unique possible consequences of a few simple assumptions may have to be abandoned. (119)

The promise of a simple and explainable universe still holds a certain appeal—although the truth, as Hawking acknowledges, is perhaps more complex and messy. See: Stephen Hawking, *The Grand Design* (New York: Bantam Books, 2010).

Little surprise, then, that the acoustical problems with the lecture hall at Harvard were framed as one of missing math. Sabine consequently interpreted his three central tasks—those of analysis, the development of a remedy, and the establishment of general acoustical principles—as a challenge not just to follow, but in fact create, entirely new categories of numbers. But because he lacked a preexisting methodology, he would have to find new things to quantify, new relationships to measure. And to do this, he would have to perform his own kind of magic: he would have to create the "right" conditions under which the acoustical relationships bridging sound with space could be coaxed and teased into the light.

Environmental mastery was central to many of Sabine's most crucial experiments. His early research, for instance, relied on custom made instruments whose functions included the dispassionate production, isolation, and analysis of sound. Accordingly, these instruments exemplified the very kind of stability and regularity Sabine expected to observe about sound in general. One such instrument, a chronograph, was used in many of his experiments. As Sabine describes, it was

> of special design, and answered well the requirements of the work—perfect noiselessness, portability, and capacity to measure intervals of time from a half second to ten seconds with considerable accuracy ... the only duty of the observer was to [mark] the record when the sound ceased to be audible.[26]

But it was not just the measurement of time that would have to be predictable and stable.[27] The instruments he designed to introduce sound would likewise need to emit a clear, dependable, and regular tone. To accomplish this, Sabine used several unique

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[26] W. Sabine, *Collected Papers on Acoustics*, 14.

[27] Paul E. Sabine, *Acoustics and Architecture* (New York and London: McGraw-Hill Book Company, 1932), 43-44.

pieces of equipment, some of which relied on mechanically governed organ pipes capable

of generating precisely the steady flow of compression waves his research required. In

one case, a machine was fabricated by connecting a Gemshorn pipe to an elaborate

control system:

> The wind supply from a double tank, water-sealed and noiseless, was turned on and off the organ pipe by an electro-pneumatic valve, designed by Mr. George S. Hutchings, and similar to that used in his large church organs. The electric current controlling the valve also controlled the chronograph, and was made and broken by a key in the hands of the observer from any part of the room.[28]

The need for regularity and consistency emerges as a recurring theme throughout

Sabine's experiments. Indeed, as Sabine himself wrote, "the supreme test of the

investigation lies in the consistency and simplicity of the whole solution."[29]

Consequently, when sound was to be introduced, it had to be done carefully and in a

controlled manner; when it was to be measured and analyzed, it had to be done

dispassionately.

At the same time, Sabine's need for always greater and more extensive forms of

mastery—sonic, temporal, and otherwise—extended well beyond his technical

equipment. It touched also his human research subjects, whose bodies had to be properly

disciplined to listen with stable consistency. In several of his experiments, auditors were

situated throughout a test space and asked to record their impressions. The goal was, in

essence, to triangulate sound: to verify test data by ensuring that different listeners, with

only slight variations in their physical ability to hear, reached nearly identical conclusions

about the quality and nature of the sound they heard. In one such instance, the process

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[28] Ibid., 14.

[29] P. Sabine, *Acoustics and Architecture*, 14.

had three stages. The first was limited to the observations of a single person (Sabine himself), sitting in a single space, on a single day.[30] The second stage would repeat this experiment at varying intervals—days, weeks, years.[31] The third would involve evaluations made by independent and otherwise untrained observers, each of whom would record their own impressions separately:

> Two gentlemen, who were already somewhat skilled in physical observation, Mr. Gifford LeClear and Mr. E. D. Densmore, gave the necessary time to test the third point. After several nights' practice their results differed but slightly, being .08 seconds and .10 seconds longer than those obtained by the writer, the total duration of the sounds being 4 seconds. This agreement, showing that the results are probably very nearly those that would be obtained by any auditor of normal hearing, gives to them additional interest. It should be stated however, that the final development of the subject will adapt it with perfect generality to either normal or abnormal acuteness of hearing.[32]

Fundamental here was not the perceptual gaps, the differences in what people heard, but the question of how to establish an objective norm. While leaving no room for any meaningful hearing disability, or more simply, differences in opinion, it seems that, in Sabine's experiments, the presence of acoustical consensus at times preceded its actual observation.

Along with the lecture hall in the Fogg Museum, other spaces at Harvard and throughout the northeastern United States soon became "living" laboratories—though ideally lifeless and silent, both inside and out, except under the permitted, controlled conditions.[33] Each observed space was to be carefully insulated from even the most ordinary of sounds—that is, the very kind of sounds that would be audible during

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[30] Ibid., 14.

[31] Ibid., 15.

[32] Ibid., 15-16.

[33] Thompson, *The Soundscape of Modernity*, 36.

ordinary use. In practice, this often meant experiments could only be conducted at night.

In one case, Sabine explains, "[i]t was necessary to suspend work on the approach of a

street car within two blocks, or on the passing of a train a mile distant ... in Boston and in

New York it was necessary to snatch observations in very brief intervals of quiet."[34] In

equating noise with uncertainty, the ultimate goal was to establish a definite and stable

sonic profile for each space.[35]

Nearly three years after his experiments began, Sabine achieved a breakthrough.

Once he stepped back to observe his data, he noticed an emerging pattern. For any given

space, with all other conditions held constant, the exposed surface area of absorbent

material, plotted against the audible reverberation time for the space, yielded a consistent

curve. The equation he used to describe it was:

$$t = \frac{.164 \ V}{\sum (a_n \ s_n)}$$

where:

t = reverberation time
V = the volume of the room
a_n = absorption coefficient of material n
s_n = surface area of material n

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[34] W. Sabine, *Collected Papers on Acoustics*, 14.

[35] Michael Forsyth argues convincingly that the primary impetus for consistency and predictability in the design of concert halls was the changing economic structure of the societies surrounding them. He writes:

[B]y the early twentieth century, with the demand for increasingly large concert halls and opera house facilities, architects could not afford to trust to luck for the success of their auditoria; still less could they, like [Hans] Poelzig in his design for the Salzburg Festival auditorium, take flight toward a dreamlike and unsystematic world of total imagination. With the rationalist dogma, Form Follows Function, the concert hall architect began to tread the path of empirical science... (Michael Forsyth, *Buildings for Music: The Architect, the Musician, and the Listener from the Seventeenth Century to the Present Day* [Cambridge, MA: The MIT Press, 1985], 231.)

Even in this somewhat crude form, Sabine's results seemed to expose a kind of latent acoustical rationality. What had previously seemed capricious suddenly appeared predictable; what seemed shadowy and unknowable became as simple and straightforward as solving for t. There was, in the end, a simple and unambiguously mathematical way to express the relationship between a given space, sound, and the resulting reverberation time.

The impact of Sabine's discovery was almost immediately felt. Fixing an overly resonant hall—as in the Fogg Museum—meant stabilizing it, bringing each relevant variable into proper alignment. And since the total volume of a room is the one variable that cannot be easily modified, this would mean, in practice, making modifications to the others. "To adjust, in original design, the reverberation of a hall to a particular and approved value" he wrote, "requires a study of conditions, of materials, and of arrangement..."[36] For the lecture hall, this meant suspending several yards of highly absorbent fabric from the walls, which would reduce unwanted reverberation immediately. But the implication of Sabine's material and mathematical fix extended well beyond the Fogg Museum. As Emily Thompson has explained, Sabine's formula meant that

> [if] the reverberation time that resulted from such a calculation [was] deemed unsatisfactory, an architect needed only to modify his design—changing the overall volume of the room, or the type or proportion of materials employed within it—until a satisfactory result was achieved. With this equation, Sabine had finally achieved the fundamental, quantitative understanding of reverberation time that he had long sought...[37]

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[36] W. Sabine, *Collected Papers on Acoustics*, 61.

[37] Thompson, *The Soundscape of Modernity*, 42.

Boston and Beyond

Outside the Fogg Museum, Symphony Hall in Boston is perhaps the most well-known place where Sabine's formula was put to use. The ideal, expressed throughout the design process, was to create an acoustical environment with about two seconds of reverberation time.[38] Sabine's formula seemed to all but guarantee that result—though implementing it would require proper management and oversight, since the casual neglect of even one element could have a cascading, negative effect on the final outcome. And indeed, there was ample reason to be cautious. The design of concert halls and theaters until this point had not been guided by specialized scientific knowledge, since no such knowledge existed.[39] The common attitude among architects—in fact, the only empirically valid attitude they could have—is best exemplified by Charles Garnier, who designed the Théâtre National de l'Opéra in Paris. In discussing the final outcome, Garnier explained something of his methodology:

> I gave myself pains to master this bizarre science [of acoustics] but ... nowhere did I find a positive rule to guide me; on the contrary, nothing but contradictory statements .... I must explain that I have adopted no principle, that my plan is based on no theory, and that I leave success or failure to chance alone ... like an acrobat who closes his eyes and clings to the ropes of an ascending balloon.[40]

Before Sabine's formula, chance was as reliable at predicting an acoustical outcome as careful planning. So, while Sabine is known to have greatly admired other halls—notably

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[38] Thompson, *The Soundscape of Modernity,* 42-44.

[39] While Sabine greatly admired the Gewandhaus, he was very clear that Boston's new hall was not a copy. He wrote:

> Assuming perfect reproduction of all proportions with like materials," he explained, "the volume would have been 25,300 cubic meters, and the absorbing power 1,370, resulting in the value, T = 3.02. This would have differed from the chosen result by an amount that would have been very noticeable. The new Boston Music Hall is, therefore, not a copy of the Gewandhaus, but the desired results have been attained in a very different way. (W. Sabine, *Collected Papers on Acoustics,* 67.)

[40] Michael Forsyth, *Buildings for Music,* 179.

the Neue Gewandhaus in Leipzig, which he used as a model for the hall in Boston—his interest was not to recreate these halls, but to reverse engineer them—to learn why they succeeded, however unknowingly.

Symphony Hall, then, would be different from the very beginning. Unlike the Neue Gewandhaus or the Théâtre National de l'Opéra, both of which succeeded essentially by luck, Boston's hall would be created in full view of the newly-discovered and mathematically-defined properties of sound. It would succeed, in effect, by design. Except, like the material composition of the hall itself, and like Sabine's earlier human test subjects—who not only had to be trained to hear a certain way, but whose conclusions were normalized—the wider listening public also had to be disciplined. For Symphony Hall to be "heard" in the "right" way, audiences would have to be trained how to listen; for its sound "to work," for the technically specified outcome to be deemed a success, a consensus would have to be built around the idea that the "designed" criteria were, in fact, the "correct" ones to notice. In effect, this would mean teaching the wider public both how to hear and which characteristics and qualities of sounds should be heard. But there was a reciprocal effect as well: in defining which sounds were important, the remains would have to be suppressed, labeled implicitly as noise.[41]

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[41] For the most part, Sabine's research interests were far more concerned with learning to actively control sound (e.g. reverberation and reflection) as opposed to suppressing it. He did nonetheless publish one article, called "The Insulation of Sound," which explores the problem of inadequate sound insulation at the New England Conservatory and the Institute of Musical Art in New York. As before, he explains, there was "no experimental data on which an architect could rely" to predict how the various attempts at sound suppression would work. In one instance, the director of the institute "tried the experiment of covering the walls of one of the rooms to a depth of two inches with standard hair felt, with some, but almost negligible, effect on the transmission of sound." Although Sabine's empirical investigations continued, "noise" suppression emerged as an entirely different form of problem, one requiring an entirely new experimental inquiry. See: Karin Bijsterveld, *Mechanical Sound: Technology, Culture, and Public Problems of Noise in the Twentieth Century* (Cambridge, MA: MIT Press, 2008).

After it was completed, Symphony Hall received a decidedly mixed reception.

Critics, for one, were hesitant. To their ears, the hall had an unfamiliar sound: certainly it

was resonant, but somehow, it was also "empty." This reaction can be seen in published

reviews, including one in the *Boston Transcript,* where William Apthorp explained his

impressions of the hall. It had "no body, no fullness," he wrote, it sounded "thin and

ineffectual."

> Moreover, the hall itself seems perfectly dead to it, it does not awake to the
> orchestra's call and vibrate with it. Things that should sound heroic and awakening,
> seem merely polite and irreproachable.[42]

In time, however, as popular sentiment took a positive turn, a few of the much earlier

mystical beliefs about sound seemed to reemerge. At least one musician thought changing

attitudes were in fact evidence of the hall itself changing. Its apparently "evolving"

acoustics were attributed to the "general drying out of the materials" used in

construction.[43] And though Sabine prepared himself to defend the hall's (and his own)

reputation, public consensus soon settled: the hall was a success.

Still today, contemporary music critics consider Symphony Hall among the best

spaces for the performance of music anywhere in the world—an evaluation that seems to

legitimize both Sabine's science and his effort to discipline listeners. Simultaneously, and

arguably incorrectly, these same critics lament that Symphony Hall was the last of its

kind, that its construction marked the end of an era. As Edward Rothstein, a writer for the

New York Times, explained in 2004:

> Symphony Hall was the last great concert hall of the 19th century rather than the first
> of the 20th. It was unaffected by Modernism. It had a single dedicated function: to

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[42] William Foster Apthorp, "Opening of Symphony Hall," *Boston Transcript* (16 October 1900).

[43] Thompson, *The Soundscape of Modernity,* 56.

serve orchestral sound. Sabine was trying to discover the nature of acoustic success, not reinvent it.

Afterward, as Emily Thompson shows ... acoustics took on a life of its own ... Increasingly, electrical tools were used not just in analyzing sound but also in reproducing sound, both in the halls and the home. The sonic frame of reference shifted.

....

This means that the hall is no longer a force that inspires particular styles of music and forms particular communities. It is instead meant to give way before their varied demands. It serves; it does not shape. So the hall has less of a focus. Instead of serving one ideal well—the ideal embodied in a 19th century orchestral hall—it serves all ideals with compromise.[44]

Nonetheless, Rothstein's analysis—of Symphony Hall in Boston on one hand, of Emily Thompson's work on the other—seems terribly wrong. Symphony Hall was not even close to the last space designed to serve the performance ideal of 19th-century music. There have been countless examples built during the last few decades alone. From the Walt Disney Concert Hall to the Berlin Philharmonie: all are meant to "serve orchestral sound," rather than be suitable for church music, rock music, or installation sound art.

In the same sense, it is difficult to view (or hear) Symphony Hall as emblematic of an earlier age, as somehow "sonically" pre-Modern. Indeed, Symphony Hall is in many respects profoundly Modern, a direct cultural and scientific beneficiary of post-Cartesian scientific rationalism, an exuberant adherent to the principles of empirical rigor. As a physical environment, the hall fits easily within a narrative that continued to unfold throughout the 20th century: of products and consumer goods, from kitchen appliances to suburban tract homes, that simultaneously create and satisfy a specific desire. Just like the multifunction spaces critics like Rothstein lament, Symphony Hall was constructed as a well-honed machine. It was planned and monitored from every angle, visually and

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[44] Edward Rothstein, "If Music is the Architect...", *New York Times*, Arts, May 22, 2004.

sonically, theoretically and practically, from idea to implementation. It was an ideal container, one designed to produce, as efficiently as possible, and with as few variations as possible, a prescribed acoustical outcome—a space not to be performed with, but performed in.

At the same time, while Symphony Hall was certainly Modern, it reflected also a much older belief about the regularity of the universe. Like so many other acoustical experiments, the hall seemed to demonstrate that the relationship between sound and space was not an exception to the material order modeled by Cartesian synthesis. And in that sense, too, Symphony Hall can be said to resemble the very spaces Rothstein deplores, those that serve "all ideals with compromise." Modern performance spaces— whether extremely "dry" recording studios, or practice modules with adaptable acoustical environments—share one important thing in common: unlike their antecedents, all are *designed*. Beyond their functional differences, what sets them apart from earlier examples is the material and generative processes that gave rise to them. And indeed, as Rothstein himself recognizes, there is inside Boston Symphony Hall a well known plaque proclaiming the space to be "the first auditorium in the world built in known conformity with acoustical laws."

If Sabine's formula marked the foundational moment of modern acoustics, then perhaps the final, public acceptance of Symphony Hall marked the moment when an aural habitus began literally to re-sound the world. As Emily Thompson writes, Sabine's research

> succeeded in many different ways, for many different groups of people. For architects, he provided the 'fixed rule' and the scientific expertise that they had long sought to guide and inform their acoustical designs. For audiences, his work

endowed the spaces in which they gathered to listen with what most listeners considered to be a satisfying sense of control. And, for scientists, [Sabine's] method established a research agenda and it identified new problems that now required solution.[45]

While Sabine himself recognized the way his discovery opened "a wide field" of investigation, it was nonetheless quickly circumscribed.[46] Perhaps not surprisingly, the primary focus of acoustical research soon became quantification and control. To begin with, the absorption coefficient of various building materials had to be determined in all of their possible variations: plaster covering tile, plaster covering wood, tile without plaster, untreated wood, brick by itself. And to market the results, entire industries were devised—some of which adopted a deceptively academic guise.[47] The full significance of Sabine's work, then, lies not solely in the way it aided the development of modern acoustics, but in how it created a form of consciousness, a way of thinking, which brought with it new economies, new forms of discipline, and new ways to establish value. It idealized the control not only of space, its physical shape and materiality, but of people, too.

Part II: Gaps and Alternatives

The history of acoustical science as I have re-presented it here tells of the progressive demystification and control of sound. It begins with the articulation of a

[45] Thompson, *The Soundscape of Modernity*, 57.

[46] W. Sabine, quoted in Thompson, *The Soundscape of Modernity*, 39.

[47] One of the most interesting examples is a publication called *Sound Control in Design*. It contains both detailed descriptions of various acoustical principles, including reverberation and sound absorption, and solutions to problem areas. "Does the sound level seem to be very high in only one area? ... If so, look for concave curved surfaces. Break them up or load them with acoustical tile." (68) Except, what seems to be helpful advice is actually cleverly concealed marketing material, published by "United States Gypsum," targeted at consumers with limited expertise. See: United States Gypsum, *Sound Control in Design*, 1959.

belief, that beneath the surface of observable reality there lies a simple and elegant truth, an equation, capable of explaining how space and sound relate. It concludes once that truth is known and widely recognized. It is, in many respects, a teleological and deterministic story, one in which the fruits of scientific inquiry are used to re-make the world, slowly but unavoidably, into something better. Uncertainty appears only as a form of technical noise to be systematically excluded, or an externality to be carefully avoided. Both are exemplified, for instance, in the way Sabine isolated the spaces he wanted to examine by excluding extraneous sounds from the world outside.

Science philosopher Ronald Giere has called this approach *objective realism*. This, he explains, is a more "sophisticated version of common-sense realism," the kind of realism we take for granted as children and that allows us to distinguish between "ordinary things," like "trees, dogs, and other people."[48] In a more sophisticated form, however, objective realism consists of three interlocking and co-dependent parts. The first "emphasizes the discovery of truths and the permanence of scientific knowledge;" the second "adds the idea that the truth to be discovered take the form of laws;" while the third "emphasizes a sense of progress toward truth."[49] In many respects, such explanations are too simple to be believed. As more critical technological and scientific methodologies have shown, objective-realist truth often depends on unchallenged assumptions and convenient exclusions.

Two critical models become relevant here, both of which encourage the construction of more subtle and complex stories about scientific discovery, technological

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[48] Giere, *Scientific Perspectivism,* 4.

[49] Ibid., 4.

development, and human achievement. The first is Actor Network Theory (ANT). Developed by a range of scholars—including John Law, Bruno Latour and Michel Callon, each coming from different backgrounds—this theory seeks to re-contextualize scientific investigation as a process of connection and collaboration.[50] In particular, ANT asks us to refocus our attention on the consent and enrollment of different actors: ordinary citizens, perhaps, who observe a problem; scientists who agree to investigate it, or otherwise abandon their research if it proves fruitless; non-sentient/non-human actors, who may or may not "cooperate" in the research. This re-modeling of traditional scientific analysis, which is usually thought to be disinterested, is important in part because it challenges us to rethink our assumptions about the role of the non-human environment—and more generally, about what we exclude and why. No longer merely a passive substance, a plane to be acted upon, both "nature" and complex human and political networks are allowed to emerge as participants—willing or unwilling—in scientific discovery, actors whose voices can be both powerful and informative should we choose to listen.

A second important critical model is the Social Construction of Technology (SCOT). Developed by Trevor Pinch and Wiebe Bijker among others, SCOT challenges the sense of inevitability that seems often to accompany scientific breakthroughs. Their work on diverse subjects—from bicycles to the Moog synthesizer and player pianos—

50 John Law, "Monsters, machines and sociotechnical relations," in *A Sociology of Monsters: Essays on Power, Technology and Domination*, ed. John Law (London: Routledge, 1991); Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1987); Michel Callon, "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fisherman of St. Brieuc Bay," in *Power, Action, and Belief: A New Sociology of Knowledge?* ed. J. Law (London: Routledge, 1986).

foregrounds the importance of trial and error, the often constructive role of false starts, market competition, failed experiments, and above all, the powerful role of cultural norms and (already operative) consumer expectations. In demonstrating that technological "closure" is achieved only through a long process of negotiation and compromise, and by challenging our tendency to focus only on "great men" and "unforeseeable" inventions, SCOT asks us to consider the possibility that scientific and technological advancement is itself a participant in, rather than the driver of, social and cultural change.

Even still, "great men" and "great buildings" remain the implicit center of acoustics criticism today. There are perhaps a few reasons why: one is that, because the history of acoustics follows the development of Modernism almost synchronically, any critique of the latter can be extended analogically to include the former—and thereby preempt the need to develop a specifically acoustical-critical discourse. Another possible reason is more complex. That is, because the study of acoustics is often framed as concerning the establishment of physical absolutes, it is subject neither to cultural negotiation, nor to influence by non-human actors. By this view, as a form of pure science, acoustics is able to plausibly avoid critique for the same reason that corresponding laws and theories of

gravity or evolution do—except, perhaps, from a few denialists, or scientific

constructivists.[51]

Not surprisingly, the few attempts that have been made to critique acoustics are

largely ineffectual. One such gesture can be found in the "popular" analysis of

architectural and acoustical failure—the study of spaces whose careful design nonetheless

yielded unwanted results, despite having been constructed in the post-Sabine era. This

approach is nowhere more clearly exemplified than in the intermittent discussion of

Avery Fisher Hall in New York. Harold Schonberg, a critic for *The New York Times*,

wrote it "has had its share of troubles from the beginning."

> It was supposed to be a concert hall with flawless sound, offering in addition the kinds of amenities and creature comforts that the venerable Carnegie Hall could not begin to match...
>
> The opening on Sept. 23, 1962, was one that nobody present will ever forget. The $21 million building was not yet finished, and the distinguished audience had to pick its way through wet concrete. ... As the concert went on, there was the horrid realization that acoustically the hall was a mess.
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> Certainly the hall was unconventional in shape—much longer in relation to its width than most other concert halls. Dr. [Leo] Beranek [the acoustical designer] had installed coffin-like acoustic 'clouds.' These were supposed to take care of all acoustic contingencies. But, at opening night at any rate, they didn't. The hall had an antiseptic sound, very weak in the bass, with little color and presence.[52]

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[51] Giere's book provides a clear account of how scientific perspectivists explain the process of experimentation and discovery:

> *[Andy] Pickering [author of Constructing Quarks: A Sociological History of Particle Physics] claims that the scientist's account [of old High Energy Particle (HEP) physics] is really a retrospective rationalization based on the independent judgment that the new HEP provides the better account of reality. On Pickering's own account, experiments were not decisive. Rather, interpreting an experimental result requires professional judgment that is subject to many influences. In particular, judgment is subject to what he calls 'opportunism in context.' Scientists interpret results partly in terms of their own expertise, the available instrumentation, and their judgment as to which approaches provide the most opportunity for doing new work, whether experimental or theoretical. For Pickering, then, adopting a new theoretical approach involves creating a new research tradition. And, finally, if the social and materials conditions had been different, the conclusion could have been different.* (Giere, *Scientific Perspectivism*, 8-9.)

[52] Harold Schonberg, "The Curse Of Fisher Hall's Acoustics," Oct 13, 1974, Sec 2 P. 21, Col 1.

The hall's problems did not begin at its opening 1962, though. Its flaws are thought to be related to a series of compromises made during the initial design process. Most significant among them was the decision to increase substantially the number of seats in the hall, a decision which necessarily forced two further compromises: a change to the hall's shape, and an increase to its total volume. Experts and critics alike consider these technical errors. And because of them, the interior of Fisher Hall was rebuilt barely a decade after it opened to poor reviews. But, once finished, these later renovations, lead by renowned architect Philip Johnson, also received a tepid response, prompting critics, including Schonberg, to later equivocate on their initially unfriendly remarks. "It could very well be," he wrote, "that the critics of the hall are overreacting."[53]

> [I]n all truth Fisher Hall is a perfectly adequate installation. And, in the shadowy realm of ear testing and psychoacoustics, there is some evidence that the highly trained ears of musicians are not necessarily the best ears for judging sound. Musicians have a tendency to listen with their brains instead of their ears; they know the music so well that listening often becomes an intellectual rather than an aural experience.[54]

Again here, like in Boston nearly a century earlier, untrained bodies become part of the problem: it is not just that the hall's design is flawed, but that the ears of musicians were "not the best" for making acoustical judgements. And again, a general consensus seemed to persist: the repairs had not been extensive enough, and many of the initial acoustical problems remained. In the decades since then, the hall developed an unwelcome reputation for being unsuitable for the performance of classical music. Indeed, writes Rothstein, "[t]he problems didn't end" with those repairs. "And so, after decades of

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[53] Ibid.

[54] Ibid.

tinkering, Lincoln Center announced ... that sometime after 2009, the hall would be gutted again."[55] These secondary renovations are slated to be even more extreme. In addition to increasing the total volume of the space (presumably, in order to bring its physical dimensions into alignment with Sabine's equation), it is hoped the hall will be altered in other, more dramatic ways, such as changing its footprint.

While the final and literal shape these latest renovations will take remains unclear, it is difficult to see how the story of Fisher Hall, and others like it, can be said to function critically. Focusing on the many ways the hall "failed" does not complicate the underlying assumptions that have guided the study of sound, nor does it situate acoustics within a larger process of cultural, political, and economic negotiation. Rather more modestly, it casts doubt upon our own technical ability to execute what are widely accepted acoustical truths, and indeed, draws into question our practical understanding of how those truths should be implemented. What emerges from a study of Fisher Hall is almost the opposite of critique: a strange form of legitimation. The hall "failed" not because the underlying theories were wrong, or because our expectations were misguided, but because the plans were applied inadequately, or because the hall was being listened to with flawed ears. Consequently, the reason we can (and continually do) label Fisher Hall a "failure" is the same reason that we believe its problems can be repaired: because of our dual impulses to regularize and control the environment, and to force our perceptions to align with aesthetic values that have been scientifically

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[55] Rothstein, "If Music is the Architect..."

determined—both of which correspond to a belief that control is possible, necessary, and desirable.

A 'Failing' Model

My emphasis on the need for critique should not be taken as nihilistic, as though to imply there are no physical or measurable properties of sound, or that those properties cannot be explained empirically. Sound does travel at a certain speed, it does move like a wave (and not a ray), it does reflect and respond to different materials and textures differently—as researchers from Bacon to Helmholtz and Bell have shown. Indeed, as science philosopher Ronald Giere explains, even from a perspectivist point of view, there is room for functional and "workable" empirical models. Developing them requires "bringing together two perspectives,"

> one observational and one theoretical, in order to decide whether the model fits the world as well as desired. The initial presumption is that the observational perspective has priority. The models of data generated within the observational perspective are to be used to decide on the fit of the model generated by theoretical principles; not the other way around.[56]

At the heart of the matter is the direction of fit. Neither fully constructivist nor objectivist, a perspectivist approach situates both observation and the observer within an inclusive context, one where the empirical act, the progressive sifting of observational data, remains contextualized. As Giere explains, this approach leaves the model itself open, so that testing it becomes

> an activity in which agents use experiments to *decide* whether or not to regard a model as providing a good fit to the objects of inquiry. This involves, among many things, deciding how probable results in the region R should be, and thus how wide R should be. This in turn requires trading off risks for two possible mistakes, namely, concluding there is a good fit when there is not and concluding there is not a good fit

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[56] Giere, *Scientific Perspectivism,* 89.

when there is. There are no general rules for making these trade-offs. That depends on the context.[57]

From a perspectivist point of view, what needs critique is not acoustical models per se, but rather the cultural, aesthetic, and evaluative mechanisms underlying them. Doing this requires returning to examine the desires which have lead the practice of acoustical research to its current point: the desire to control space by simplifying it; the desire to assemble a comprehensive picture of acoustical "reality"—an image that can be copied, adapted, and applied wherever we see (and hear) fit; the desire to construct a model of the universe that conforms to our most reduced and simplified experience; the desire to express sound (and in the process, some parts of human experience) simply, elegantly, and mathematically, rather than in a way that embraces complexity, diversity, and experienced difference.

Mounting a sufficient critique requires, from the beginning, a different view of Sabine's discovery. For instance, what is commonly understood as his "breakthrough moment," the discovery of the acoustical formula, can be viewed, from a Lacanian point of view, as a kind of "lack" filling a pure void. The lack does not itself consist of sound or even mathematics, but the quest to uncover a universal constant, a bridge binding sound and space together inextricably, a tool that could be manipulated and controlled. In this way, the presence of some fixed, foundational acoustical property was anticipated from the start—only its particular configuration was unknown. And it was on account of this that Sabine spent so much time working to create improbable acoustical environments: silent, laboratory-like spaces, without much resemblance to the conditions of ordinary

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[57] Ibid., 90.

use, filled with carefully initiated listeners. Sabine's discovery, in a way, made sense because it was assumed to be there. It seemed simple, because simplicity was already part of the solution. It was compelling, not just because it was verified empirically, but because it articulated a collection of expectations for what would be found. And by confirming that sound and space did, in fact, relate predictably and controllably, it confirmed also long-held assumptions about the configuration of the natural world.

The formula, the numerous technical and practical applications to which it has been put, and the listening bodies that have been trained to hear the results all undoubtedly "work." They are part of a vertically-integrated network, an effective (though not necessarily sinister) collusion of science and culture. But it is important to understand what these formulas, equations, and theories are not: a decryption, an exposition of the reality of everyday life. Critique, in a much broader sense, therefore means developing an alternate and more inclusive "image," one that challenges our desire to master and control sound while leaving room for the emergence of difference, the unfolding of progressive change.

Critical Imagery

There is, indeed, another story to be told here. While it is not one that fits neatly into either an objectivist or deterministic narrative, it does offer an alternate way to understand the relationship between sound and space. And it begins, again, with the work of Wallace Sabine—viewed this time from a completely different perspective. Not all of Sabine's research was focused on the problem of reverberation. Some of his work, arguably the less frequently celebrated parts, was concerned with understanding the

variable intensities of sound, the way in which sound moves through and saturates space, and the emergent sonic effects such movement generates. Sabine observed, for instance, that the physical shape of a space can greatly influence the way sound behaves within it. While the ultimate purpose of this research was to examine the emergence of secondary and ternary reflections, important here are the tools and techniques he used along the way.

Often enough, Sabine used an unusual medium to display his results: graphical representations that make visible in an almost uncanny way the physical interaction between space and sound. These representations are what I call *sound maps*—contextual and relational images showing the movement of sound as it changes in response to the lived-configuration of space. They resist our tendency to draw broad and universalizing conclusions. Instead, more modestly, sound maps have an illustrative function. Their purpose is to make plain the audible complexities within space, to help us document the behavior of sound as it can be actually observed. They are constrained images; and while not particularly amenable to either extrapolation or generalization, their purpose nonetheless gestures toward bringing into dialogue ordinarily incompatible domains: the spatial and sonic; the measurable and experiential; the visible and audible.

Many such maps can be found published throughout Sabine's papers. Significant examples can be found in his article "Architectural Acoustics,"[58] where Sabine also takes some time to explain how and why they were made. In one particular instance, while studying a rectangular room with a vaulted ceiling at the Naugatuck Congregational

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[58] W. Sabine, *Collected Papers on Acoustics,* 219-236.

Church in Connecticut, Sabine took note of audible variations in the intensity of sound, as

they could be observed at various points throughout the room. The image did not show a

smooth or sound-saturated field, but neither were the results unnoticeable or insignificant.

As Sabine describes, "[t]he phenomenon indicated in these diagrams,"

> was not ephemeral, but was constant so long as the source of the sound continued,
> and repeated itself with almost perfect accuracy day after day. Nor was the
> phenomenon one which could be observed merely instrumentally. To an observer
> moving about in the room it was quite as striking a phenomenon as the diagram
> suggest.[59]

The accompanying map shows an almost incredible aural topology. (Figure 1-2) Space

and sound, even under highly controlled conditions, are shown together producing peaks

and valleys, points of quiet and points of intensity, pockets where sound snags and

gathers. But the results were not just visible; they were audible, too. Sabine explained

that

> [a]t the points in the room indicated as high maxima of intensity in the diagram, the
> sound was so loud as to be disagreeable, at other points so low as to be scarcely
> audible ... [60]

But the results were not universally applicable either. A simple change in position, the

introduction of a new wall or partition, a change in the intensity of sound, could have a

noticeable effect on the shape and contour of the resulting image. Sabine writes,

> [h]ad the source of sound been at one end and on the axis of the cylindrical ceiling,
> the distribution of intensity would still have been bilaterally symmetrical but not
> symmetrical about the transverse axis.[61]

The effect represented on the map was audibly inconsistent, contingent on special

conditions, but clear enough so the variations themselves could be easily noticed.

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[59] W. Sabine, *Collected Papers on Architectural Acoustics*, 234.

[60] Ibid., 234-35.

[61] Ibid., 234-35.

Nor is this image unique within Sabine's work. In another instance, Sabine undertook research inside a temperature controlled space in Harvard's physics building. During the resulting experiments, Sabine ran a film-operated recording device along a string-guided path. When pulled, the recorder spiraled toward the center of the space. By connecting relative intensity readings plotted on a spatial diagram, he discovered remarkable but symmetrical variations in the intensity of sound. The resulting contours underscored the way even a single, sustained tone could yield quite unequal results, even within the rigid confines and apparent consistency of a tightly regulated environment.

Sabine believed diagrams like these had a practical use beyond their informational applications in research. They could help provide, for instance, "a partial explanation of the so-called deaf regions in an auditorium"—a demonstration of which can be found in his study of the New Theatre in New York.[62] To study why the sound of the hall unfolded as it did, Sabine created a series of scale models, each showing a slightly different view of the hall—for instance, its footprint, viewed from directly above; or a cross section, viewed from the side. Later, "the sides of a model are taken off and, as the sound is passing through it, it is illuminated instantaneously by the light from a very fine and somewhat distant electric spark."[63] This photographic technique, called *schlieren-Methode,* shows how a single, pulsed wave interacts with the permanent, physical structure of the hall. (Figure 1-3) Enough photographs taken in quick, film-like succession can reveal useful insight into how sound waves change as they move through the full-sized hall.

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[62] Ibid., 232.

[63] Ibid., 236.

For the New Theatre specifically, Sabine explained "the present case ... would have predicted almost perfect acoustics in the boxes and on the main floor."[64] What the images showed, instead, was that:

> [t]he wave c_1 has advanced and is reaching the front row of seats in the gallery, producing the effect of an echo. A little later it will enter the balcony, producing there an echo greater in intensity, more delayed, and affecting more than half the seats in the balcony, for it will curve under the gallery, in the manner just explained, and disturb seats which geometrically would be protected. Still later it will enter the foyer seats and the boxes. But the main disturbance in these seats and the boxes, as is well shown by the photograph, arises from the wave c_2, and in the orchestra seats on the floor from the wave c_3.[65]

Indeed, while Sabine seldom comments on visual diagrams like these—as if to suggest what they show is self-evident—he does at times overstate their importance. Despite what he suggests above, for instance, it is not clear these images explain anything, partially or otherwise. Rather, they function diagrammatically to exemplify how sound intersects with space. In depicting movement and change, they show how audible differences, heard even within the confines of a single space, are not merely figments of our perception, but emergent, material fluctuations that appear as sound itself moves through and interacts with the environment. Space and sound, these images suggest, are not purely or independently manipulable in an abstract sense. They are co-dependent, or rather, co-productive, forces that change depending on the material circumstances, the sometimes literal shape and context of observation.

Sabine was not the only scientifically-minded person during the early 20th century to develop new ways to "visualize" sound. Another person perhaps even more famous than Sabine was Dayton Miller, whose Phonodeik, invented in 1908, was designed to

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[64] Ibid., 184.

[65] Ibid., 184.

create "photographic images of sound vibrations."[66] In some respects, the Phonodeik's

technical operations more resembled a phonograph than Sabine's spiraling sound

machines: sound entered a large horn causing a diaphragm to vibrate; simultaneously,

light was projected toward a small mirror, connected to the diaphragm using a small

string. The image reflected from the mirror would shake and vibrate according to the

frequency of sound entering the horn—and the result caused a popular sensation.

Thompson explains:

> Miller became known as 'The Wizard of Visible Sound' as he traveled across the country demonstrating his device. In 1914, Wallace Sabine invited Miller to give a series of public lectures ... and the *Boston Evening Transcript* reported that the audience was 'fascinated' by his graphic representations of music and noise. Miller's sound images were seen by millions more when they appeared in newspaper advertisements for the Aeolian-Vocalion phonograph.[67]

Miller's images share at least one important similarity with Sabine's maps: their attempt

to translate something audible into something visible, to show sound as a moving and

changing, even when apparently held constant. But there are even more significant

differences between them. For one, Miller's images are not "spatial" in the same sense as

Sabine's. While the final image certainly occupies space—the abstract frame-space of the

projection itself—Sabine's images operate by locating sound within the physical

environment, an environment that is already occupied by a listener (or perhaps a

"listening" machine). In that sense, it might be that Sabine's images do not so much

spatialize sound as sonicize space: they "charge" the diagrammatic image by finding it

already audible.

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[66] Thompson, *The Soundscape of Modernity*, 86.

[67] Ibid., 87.

A photograph made using *schlieren-Methode* might not fit our immediate conception of a sound map in the same way that Sabine's hand-drawn schematic of the church in Naugatuck does, but sound maps are not limited to any one particular medium;[68] instead, they construct a sensory and conceptual bridge, one that links abstract notions of sound and space to the fluid impermanence of experience. What matters, then, is the way these maps help us to picture space as "textured," rather than more simply "filled;" what matters is how they function and the relationships they mediate. Sound maps encourage us to re-imagine the everyday environment as determined by audible differences—differences which are themselves shaped by where one sits, or how one moves. They provide justification for us to hear space as constantly in motion and filled with sound—sound which itself moves, collects, and gathers unevenly in response to the changing material circumstances of space.

Maps like these are important, then, not just because they create a new way to study sound—namely, by representing it graphically and spatially—but because they encourage us to develop an entirely new conception of it: a new "sonic consciousness" that allows us to think, view, and listen to the world as defined already by difference.

Sound Maps In Theory

Sound maps are unusual because they provide insight into what I have referred to as the acoustical textures of space. But in many ways, the idea of a sound map—the simple representation of sound existing in space—might be said to be very old indeed. A

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[68] In the past, a clearer distinction was drawn between (what was considered to be) a map and a photograph. But these distinctions have become increasingly blurred, however, as cartographic representations have become intertwined with photography. While the details of this topic are best left to historians in art history and cartography to parse, it is a subject that does obliquely concern urban and environmental sound maps, and will therefore be addressed in Chapter 2.

primitive sound map, for instance, can be found in the work of Athanasius Kircher, who not only described but illustrated any number of peculiar sonic effects, including the mysterious way that sound, under the right conditions, could be observed to bounce from one point to another—a phenomenon Sabine would later explore in his writing on "Whispering Galleries."[69] Kircher suggested this peculiar, almost playful property of sound could be used to create covert eavesdropping systems, the illusion of speaking statues, or multiple echoes. Indeed, in two of Kircher's key texts, *Musurgia Universalis* and *Phonurgia Nova*, he illustrates these effects not simply by showing the underlying architectural feature, he also (and literally) draws sound into the image—though technically incorrectly, as a ray—to demonstrate how it can be heard bouncing from place to place. (Figure 1-4)

Certainly Sabine's and Kircher's visual diagrams do bear some resemblance, since both represent sound, its movement through space, and its interaction with the physical environment. But there are also important differences between them. Ultimately, Kircher's diagrams were meant to explain how a specific acoustical phenomenon could be observed and manipulated, while the images themselves show little more than speculative detail.[70] Sabine's maps, by comparison, take a more rigorous approach to the idea of "mapping" sound. Whether photographic or drawn by hand, they are meant to explain not only *that* acoustic tricks exist, but to demonstrate in detail *how* they were observed on a specific occasion. They function instrumentally to help us see how space

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[69] W. Sabine, 255-276.

[70] I mean "speculative" here in the technical sense explained by Gouk: as a form of investigation aimed at producing certain effects. See: Gouk, *Music, Science, and Natural Magic*, 93.

and sound interact, how they are mutually articulated, and how we might find ourselves

caught in between.

Sound maps like Sabine's are not merely locational, however; they are also

orientational. That is to say, it is not their sole function to help us identify where

something is in space (e.g. the location of a whispering gallery), or to help us find better

ways to make use of a particular effect. Also, and more significantly, these maps help us

locate ourselves in relation to change itself. They stand to help us better appreciate our

relationship to and dependence on sound, its movement and its variation. In articulating a

series of important relationships—both spatial and sonic—sound maps become a critical

mechanism, one that can help us re-inject listening subjects and a sense of everyday

experience back into an otherwise distanced and disinterested analytical frame.[71]

In that sense, sound maps are important for reasons Fredric Jameson would later

identify in his work on "cognitive mapping." He writes:

> ...we have this split between ideology in the Althusserian sense—that is, how you map your relation as an individual subject to the social and economic organization of global capitalism—and the discourse of science, which I understand to be a discourse (which is ultimately impossible) without a subject. In this ideal discourse, like a mathematical equation, you model the real independent of its relations to individual subjects, including your own. Now I think that you can teach people how this or that view of the world is to be thought or conceptualized, but the real problem is that it is increasingly hard for people to put that together with their own experience as individual psychological subjects, in daily life.[72]

Jameson's ultimate point here was made, in a much more technical sense, by Giere earlier

in this chapter: that there exists a division between the world as it can be seen, measured,

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[71] At least one of Kircher's diagrams also pulls in this direction. The image in Fig. 6, from *Phonurgia Nova*, is accompanied by a text that speculates how sound might be used as a weapon, capable of spreading disinformation among an invading army.

[72] Fredric Jameson, "Cognitive Mapping," in *Marxism and Interpretation of Culture*, eds. Cary Nelson and Lawrence Grossberg (Urbana, IL: University of Illinois Press, 1988), 358.

and objectified, and how it is experienced subjectively. As the former, what Jameson calls

an "ideal discourse," develops and increases in complexity over time, it simultaneously

becomes difficult for ordinary people, "individual subjects," to locate themselves in

relation to it—that is, to make sense of the world in terms the ideal discourse itself

provides.

The result, Jameson suggests, is that people must be taught how they fit as pieces

into a larger puzzle of ontology—what we might call the social, scientific, and political

real. Cognitive mapping, as Jameson describes it, offers an alternative. Without resorting

to reduction, it empowers people to go out into the world, to observe it as complex and

contradictory, to examine "their own experience as individual psychological subjects, in

daily life." It provides a different way to study the world as dynamic and relational, rather

than a collection of idealized facts, divorced from time, experience, and change, or even

more ominously, defined from the "outside."

Like maps of weather, maps of sound are not strictly cognitive; there is usually an

external, sensorial, and material dimension to them. Nonetheless, as I have worked to

define them here, their development and critical usefulness very much follows the pattern

Jameson outlines. It is certainly true they emerged alongside an "ideal discourse"—the

development of acoustical science. They are, in that sense, a byproduct of our search for

an abstract model of reality. Sound maps retain also some practical and scientific utility,

for instance, in the study of sound reflections in the modern concert hall; but in a broader

sense, sound maps themselves can also be studied, placed in the context of our own

theoretical efforts to understand the experience of sound, its movement and fluctuations over time and space.

In that sense, maps of sound nudge us, even if only slightly, towards a greater appreciation of space as someplace internally differentiated. They furthermore suggest what we commonly identify as "a space"—defined, perhaps, by a shared material context ("four walls and a roof"), or a rough set of geo-spatial coordinates ("second floor, first room on the left")—is not, in the final analysis, completely uniform. To the extent that "a space" is singular, it might in fact be defined by its differences. Philosopher Gilles Deleuze has explained this notion more generally in terms of "formal" and "modal" distinctions. He writes:

> *Formal distinction* is, in effect, a real distinction, since it is grounded in being or in the object; but it is not necessarily a numerical distinction because it is established between essences or senses, between 'formal reasons' which may allow the persistence of the unity of the subject to which they are attributed ... [M]odal distinction, is established between being or the attributes on the one hand, and the intensive variations of which these are capable on the other. These variations, like degrees of whiteness, are individuating modalities of which the finite and the infinite constitute precisely singular intensities.[73]

By this reckoning, a "formal" distinction allows us to implicate space as singular— something we can talk about as distinct or contained. Similarly, a "modal" distinction concerns the textural dimensions that differentiate space from itself. But the underlying ontological plane upon which modal distinctions are drawn lies elsewhere, in the concept of "univocity." He explains:

> [T]he essential in univocity is not that Being is said in a single and same sense, but that it is said, in a single and same sense, of all its individuating differences or intrinsic modalities ... The essence of univocal being is to include individuating differences, while these differences do not have the same essence and do not

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[73] Gilles Deleuze, *Difference and Repetition*, trans. Paul Patton (New York: Columbia University Press, 1994), 39.

change the essence of being—just as white includes various intensities, while remaining essentially the same white.[74]

This definition can be extended almost directly onto sound maps. In them, we see how space is composed of "individuating differences"—places where the material environment, for instance, effects change in the intensity of sound, forcing it to gather, snag, or bunch together in response to the surrounding space. While identifying these tendencies does not, on its own, "change the essence" of a space, it is by locating them that we are all but compelled to acknowledge what space is not: uniform, easy to simplify, fully consistent, or perceptually smooth throughout. Just as the color we casually call "white" is composed of many different frequencies of light—and yet appears coherent—what we might commonly call "space" is, in effect, internally differentiated, shaping and shaped by what happens and how.[75]

As maps, these images foster a spirit of experimentalism (rather than simply experiments); they encourage us to experience the world (rather than remove experience from it). Deleuze explains:

> ...[the map is] entirely oriented toward an experimentation in contact with the real. The map does not reproduce an unconscious closed in upon itself; it constructs the unconscious. It fosters connections between fields ... The map is open and connectible in all of its dimensions; it is detachable, reversible, susceptible to constant modification. It can be torn, reversed, adapted to any kind of mounting,

[74] Ibid., 36.

[75] Another of Deleuze's ideas is relevant here: *deterritorialization*. That is because there is an inherent irony in Deleuze's choice of examples. Isaac Newton, of course, is widely recognized as the first scientist to split light into a spectrum of color. And yet, for Newton, the fact that light could be split into so many parts was not evidence of internal difference, the univocity of white-ness, but rather an explanation of what white-ness was. Like Deleuze, I am suggesting that the history of science might be read differently, and that the products and outcomes of scientific research suggest a much more complicated version of "reality" than we ordinarily see.

reworked by an individual, group, or social formation. It can be drawn on a wall, conceived of as a work of art, constructed as a political action or as a meditation.[76]

Sound maps allow us to perform a "deep" analysis—not one with clearly identifiable or fixed endpoints, but one that seems ongoing, unfinished, or un-finishable. They function as a counterweight to more common analytical modes, especially those driven toward fixity and stability. Sound maps instead ask us to think about space differently by taking the logic of acoustical trick spaces—the logic of whispering walls and parabolas (the kind of spaces admired by Wren, Bacon, and even Sabine)—and multiplying it. They suggest all spaces, vaulted or not, designed specifically as "musical" or "sonic" or not, are worth listening to. And in doing so, they make possible different forms of engagement where space, sound, and our experience can "be torn, reversed ... reworked by an individual, group, or social formation."[77]

The 'Real' of Sound
Sound maps are very limited, at least in a representational sense. For instance, Sabine's most commonly reprinted sound map, the isobel shown in Figure 1-2, depicts sound only at a very generic "head" level. Other maps have an uneasy relationship with time. Some are quite specific about the "moment" they show: photographs made using *schlieren-Methode*, for instance, are quite clear in mapping not only a narrow "slice" of space, but a very brief instant of time. Other maps, however—especially the types I will discuss in Chapter 2—adopt a more vague approach to temporality, perhaps by showing

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[76] Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi (Minneapolis and London: University of Minnesota Press, 1987), 12.

[77] Ibid.

an extended moment during which many sounds, heard by many different people and at many different "head" levels, are condensed into a single frame. Attempts to map more complex forms of experience render these limitations especially acute. A musical performance; the sounds of a city; sounds made at different volumes and durations; sounds projected at different angles and heard at different "head" levels: the process of mapping, at some point, becomes so complex that it careens toward overdetermination. It would seem, quite simply, that there is too much to hear, and too much space to hear it in.

This paradox is a familiar one: the more we hope to represent something accurately, the less we seem able to do it. Neither is there an easy escape. Creating "better" images, using more compelling and comprehensive forms of representation—moving images, 3D images, virtual realities with interactive graphics and embedded sound samples—does nothing but defer the problem, principally by relocating the phenomenological gap between represented and representation.[78] More information, even finely grained and compellingly presented, will not provide any more certain, fixed, or stable access to the sonic indeterminacies of space. The alternative notion, that of a totally-mapped environment, one so complete that it becomes indistinguishable from reality, has been parodied and critiqued extensively, from Borges to Baudrillard.[79] But perhaps no parody is as compelling as Lewis Carrol's, found in his 1893 novel, *Sylvie and Bruno Concluded*:

> "That's another thing we've learned from *your* Nation," said Mein Herr, "map-making.

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[78] This issue will be revisited extensively in Chapter 2.

[79] Jorge Luis Borges, "On Exactitude in Science," in *Collected Fictions*, trans. Andrew Hurley (New York: Viking, 1998); Jean Baudrillard, *Simulacra and Simulation*, trans. Sheila Faria Glaser (Ann Arbor, MI: The University of Michigan Press, 1994).

But we've carried it much further than *you*. What do you consider the *largest* map that would be really useful?"

"About six inches to the mile."

"Only *six inches!*" exclaimed Mein Herr. "We very soon got to six *yards* to the mile. Then we tried a *hundred* yards to the mile. And then came the grandest idea of all! We actually made a map of the country, on the scale of *a mile to the mile!*"

"Have you used it much?" I enquired.

"It has never been spread out, yet," said Mein Herr: "the farmers objected: they said it would cover the whole county and shut out the sunlight. So we now use the country itself, as its own map..."[80]

Sound maps, like maps of any other kind, are formally incomplete—not out of weakness, but necessity. The alternative, a "fully complete" sound map, one claiming to be the precise or exact translation of what it shows, borders the absurd.

And yet, there remains at least one important question. Aside from the inherent limitations and partiality of representation, what is to prevent sound maps from becoming a "totalizing image"? Maps, indeed, are not usually valued for being "detachable, reversible, and subject to constant modification," as Gilles Deleuze and Félix Guattari explain. Nor are mapped inaccuracies and inconsistencies usually celebrated as such. Maps, instead, are usually valued for being accurate and authoritative, for helping us from location-A to location-B without getting lost. And in that sense, as will be discussed in Chapter 2, maps are instruments of power and control. So what, then, prevents sound maps in particular from exemplifying the very form of objective realism they otherwise serve to critique?

Perhaps the shortest way to respond is by saying that sound maps operate in the Symbolic domain. But to explain what this means—generally, in terms of Lacan, and

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[80] Lewis Carrol, *Sylvie and Bruno Concluded* (New York: MacMillan and Co.,1893), 169.

specifically in terms of the sound map—it is necessary to dip into psychoanalytic theory. As Stephen Friedlander defines it, "[t]he Symbolic is, properly speaking, not an element of experience but a constraint on experience."[81] As a category, it encompasses most representational and communicative codes, including language, which funnel what we think, and what we hope to say, through a series of filters. But the Symbolic is more than just a filter. As work in linguistics and deconstructionist philosophy has shown, once these filters become engrained both within individuals and the broader culture, they begin to shape and direct our thoughts and desires from the start. It is at this point that constraints themselves become formative, even productive—and consequently, worthy of analysis.

This process functions similarly with sound maps. Not only do they have the potential to communicate and represent experiences that have already been had, they stand to shape and filter those that might occur in the future. To examine a sound map means, on some level, appreciating its potential to function critically, to investigate the relationship between sound and space, not just as "truthful" or "accurate," but as a lens that focuses (and subsequently distorts) the world as we experience it. That lens, in turn, imposes its own constraints. Sound maps cannot be totally comprehensive, even when limited to a single observational category like "loudness," because as Carroll's earlier parody suggested, even condensing all of the information ever collected about sound, made to represent every possible loudness measurement, would still not provide a "totally mapped" image—since, at the very least, the image would be "out of time." Holes, then,

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[81] Stephen Friedlander, "Glossary of Lacanian Terms," in *The Subject of Lacan: A Lacanian Reader for Psychologists,* eds. Kareen Ror Malone and Stephen R. Friedlander (Albany, NY: State University of New York Press, 2000), 366.

are both inevitable and necessary, but not necessarily detrimental. If anything, these shortcomings are productive, principally because they open the map to new kinds of contributions.

So, the reason sound maps do not function as a hard constraint—the reason, that is, they do not idealize the control and domination of the audible environment—is the nature of their subject, what might be called the "sonic Real." As philosopher Slavoj Žižek writes, it is precisely when we believe we have captured the Real that we are forced to confront a deeper, more complex truth; "[i]t is not that reality entered our image: the image entered and shattered our reality (i.e. the symbolic coordinates which determine what we experience as reality)."[82] Sound maps are important, in this sense, because of the way they change both what is possible to be viewed and how we view it. It is not that the Real of sound is captured by the map; it is rather that maps have been caught in a swirling vortex of sound's Real.

To some extent, this is due to the nature of the Real itself. To begin with, the Real refers not to some knowable, objective, or material configuration of the world. Its essence, to the extent it has one, cannot be known or seen directly, neither can it be expressed abstractly as a number, a property, a painting, or in a musical composition. As a category, the Real includes both material states and immaterial properties, conscious and subconscious experiences. This, by nature, makes it difficult to grasp since, in nearly any circumstance, approaching it, triangulating it, requires the passage or mediation of information through successive layers of observation. Studying the Real requires

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[82] Slavoj Žižek, "Welcome to the Desert of the Real," in *The Symptom* 2 (Spring 2002), http://www.lacan.com/desertsymf.htm (accessed 27 September 2011).

excavating and observing what bubbles up from beneath our most immediate analysis of

the world and ourselves—accessing it, even obliquely, requires probing surface-level

observations in pursuit of something beneath. The result consequently entails the passage

of information through the Symbolic domain, which as mentioned above, includes both

cultural and communicative codes, such as language, speech—and arguably sound maps,

too—which add further layers of meaning and complexity.

Neither is pursuing the Real necessarily a linear and straightforward process.

Ordinarily, it is one that requires repetition and deep (self) investigation. Each layer, each

peeling back of the observable surface, reveals rich complexity, a kind and diversity of

experience filled with deep signification that may, on its own, require yet further

investigation. The difficulty inherent to this process has been explained by Mark Bracher,

an English professor and expert on psychoanalytic theory, as rooted in the "radical

incommensurability between system and non-system."[83]

> On the one hand, subjectivity is a function of systems—Symbolic and Imaginary, or
> verbal and imagistic—that organize different perceptions, memories, thoughts,
> feelings, desires, and enjoyments in relation to each other. On the other hand,
> however, there are also present within subjectivity 'impressions without memory,'
> which constitute what Lacan calls the Real. Lacan defines the Real as that which
> resists symbolization absolutely ... [The Real] includes intense events (or aspects of
> events) of our later life that cannot be fully grasped by our perceptual or cognitive
> structure and categories.[84]

Because the Real "resists symbolization," even when we think we have accessed or

contained some part of it, we can never be quite sure we have succeeded. Žižek, for

instance, situates this uncertainty within a three-staged encounter.

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[83] Mark Bracher, "How Analysis Cures According to Lacan," in *The Subject of Lacan: A Lacanian Reader for Psychologists,* eds. Kareen Ror Malone and Stephen R. Friedlander (Albany, NY: State University of New York Press, 2000), 191.

[84] Ibid., 191-92.

> The Real is first there as the anamorphic stain, the anamorphic distortion of the direct image of reality—as a distorted image, a pure semblance that 'subjectivizes' objective reality. Then the Real is there as the empty place, as a structure, a construction that is never actual or experienced as such but can only be retroactively constructed and has to be presupposed as such—the Real as symbolic construction. Finally, the Real is the obscene, excremental Object out of place, the Real 'itself.'[85]

> These three dimensions of the Real result from the three modes by which one can distance oneself from 'ordinary' reality: one submits this reality to anamorphic distortion; one introduces an object that has no place in it; and one subtracts or erases all content (objects) of reality, so that all that remains is the very empty place that these objects were filling.[86]

The underlying problem, the reason this encounter takes place in phases rather than all at once, is that "[t]he core of our being is partially obscured, and this is why we very often cannot decide what it is we really wish,"[87] and furthermore that "meaning and truth escape representation, partially or in toto."[88]

This encounter with the Real is mirrored also in areas other than psychoanalysis. Lacan himself located both the structure of the Real and the necessity for a multi-phased encounter among scientific inquiry generally, the work of mathematician Kurt Gödel specifically. The reason, as theorist Alexandre Leupin has explained, is that

> [t]here is an infinite number of theorems whose validity cannot be proven or disproven. In order to validate [a fundamental] theorem, which often constitutes the basis of reasoning, the scientist has to resort either to an arbitrary decision (to transform the theorem into an aporia) or to another scientific system (which puts into question the rational unity of his own field and shows that this field cannot aspire to a totalization).[89]

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[85] Slavoj Žižek, "The Real of Sexual Difference," in *Interrogating the Real,* eds. Rex Butler and Scott Stephens (London and New York: Continuum, 2005), 339-340.

[86] Ibid., 340.

[87] Alexandre Leupin, *Lacan Today: Psychoanalysis, Science, Religion* (New York: Other Press, 2004), 47.

[88] Ibid., 48.

[89] Lacan "Radiophonie," quoted in Leupin, *Lacan Today,* 53.

The attempt to "close" science, to create all-encompassing explanations becomes, if not self-referential, at least self-concerned. The ultimate outcome is incommensurate with what we experience, and therefore ultimately impossible to reconcile with empirically-determined fact. All of the images and models science produces are bound to be distorted —and by relying on a recursive justification, they permit the Real-Real to continually slip by or stay hidden. Leupin comments:

> Such interventions demonstrate that the subject of science cannot be envisioned as complete or whole but is open to an arbitrary decision or divided by the ultimate nonunity of its field. In other words, the impossibility of completeness underlines the fact that the subject of science cannot be 'sutured' (that is, be determined, and thus closed, in an entirely rational fashion.)[90]

We cannot, practically or literally, have all of the facts about everything. It is therefore important to distinguish the Real from what we commonly call "reality." The latter, as Žižek explains, "is always a fictional image," a figment of the imaginary rather than the Real proper, one where "[i]dealism and nominalism are both trapped ... in thinking that the reality of signification is indeed equal to the Real order of meaning."[91] The Real functions, then, not as an absolute collection of facts, but as a kind of trauma—one that is subsequently buried or coded, always beyond reach, capable of being understood only by analyzing the peculiar shadows it casts, unraveling the strange, stained, or stretched representations, like sound maps, that result. Paradoxically, then, it is by trying to represent reality that we find it absent; and it is precisely in finding it absent that we return to (re)represent it. Bruce Fink writes,

> [i]t is the non-representational nature of the real that brings on repetition, requiring the subject to return to that place of the lost object, the lost satisfaction. Every other

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[90] Leupin, *Lacan Today,* 53.

[91] Ibid., 47.

satisfaction pales in comparison with the one that was lost, and the subject
repeatedly returns to the site of that absence in the hope of obtaining the *real Thing,*
and yet forever missing it.[92]

To synthesize Žižek and Fink's analysis, then, we can say that the Real appears first

as a shadow, a "stain" for which no explanation seems possible, but which, at the same

time, seems to influence everything surrounding it. It appears next as a Symbolic

construction, as an image: a form of representational power that is never directly

experienced and, if too strongly believed, whose effectiveness easily evaporates. Finally,

the Real is rendered an elusive, even obsessive and rhythmical repetition: a place—literal

or metaphorical—to which we return again and again in the hope of finally

understanding. And yet, it continually evades us. Each view we construct of it results in

yet another stretched image, another partial glimpse, requiring yet further investigation,

further participation, more insight from more people.

It remains to be clarified how this Lacanian model rescues sound maps from

becoming a totalizing force—the kind of grand, unifying explanation I have suggested

they serve to critique. The answer begins by noticing the way sound maps first appear, as

a kind of distortion. They emerged even within acoustical research as images out of

place, as representations that stretch or challenge our sense of sonic awareness. By

highlighting the way space is not uniform or smooth, but rather textured and

differentiated even within itself, they can, if we allow them, be analyzed critically as a

form of representation that helps to "determine what we experience as reality."[93]

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[92] Bruce Fink, "The Real Cause of Repetition," in *Reading Seminar XI: Lacan's Four Fundamental Concepts of Psychoanalysis,* eds. Richard Feldstein, Bruce Fink, and Maire Jaanus (Albany, NY: State University of New York Press, 1995), 228.

[93] Žižek, "Welcome to the Desert" 16.

Despite appearing both clear and complete, sound maps nonetheless have important limits and should not be confused with purporting to represent the "sonic Real" itself. Sound maps, instead, open up the possibility of mappings and re-mappings. They gesture toward circumscription but, because of their nature as maps, can never fully fix or define the Real itself. Instead, sound maps initiate a cycle of repetition grounded in a persistent sense of incompleteness, driven by an impossible or "lost thing." In the end, they are not designed—and arguably cannot be designed—to solidify our relationship to space, to decode it "once and for all." Rather more modestly, as will be explored throughout the remaining chapters of this dissertation, they enable us to observe the way in which space and sound interact co-productively while disempowering any further attempt to universalize the outcome as necessary or absolute.

Conclusion

I began this chapter by exploring the history of sound research at a time when experimental methods blurred the boundary between "magic" and "science." The field we recognize today as architectural acoustics emerged only much later, with the work of Harvard physicist Wallace Sabine. It was he who made a key discovery at the turn of the 20th century: a simple and elegant mathematical equation that could be used to control reverberation. Sound, in the end, appeared not as some mysterious force, but one that is knowable and predictable—and whose behavior can be understood and explained, literally, by the numbers. Sabine's discovery had a profound effect, not only on the way we analyze and design space, but on how we conceive of ourselves in relation to it. And yet, in becoming idealized, it had the effect of creating what Fredric Jameson calls a

"discourse without a subject:" a conceptual framework that is, if not beyond experience, then removed from it.

This realization highlights the need for an acoustical-critical discourse, one that makes difficult our cultural and scientific desire to study sound only in order to better control it. The limited form of critique that does exist is exemplified in the discussion of "failed" acoustical spaces; but this leads down a paradoxical and unhelpful path of negative legitimation. In many respects, the study of acoustical failure is used to highlight our own human inadequacies: our inability to actualize plans with precision, our tendency to hear spaces in ways not approved by the numbers. Missing, then, is a mode of critique that stops short of outright scientific denialism, but that resonates with contemporary methodologies such as Actor Network Theory (ANT) and the Social Construction of Technology (SCOT)—both of which view scientific discovery and technological development as an uneven and fundamentally cooperative process.

Constructing this kind of critique remains possible; and one way to do it, I propose, is by re-directing our focus within the already extant narrative of the development of acoustical architecture. Except, rather than studying the relationship between space and sound as fixed and stable, we can foreground its dynamic elements, re-contextualizing them as (what Deleuze and Guattari called) "univocal." Surprisingly, the published papers of Wallace Sabine again provide a compelling starting point. Included among them are numerous schematics, photographs, and diagrams made to show how sound moves and flows, gathers and collects, in uneven and sometimes unforeseen ways. These images—a form of visualization I call the "sound map"—highlight a different way of

thinking about sound-space relationships. While they do not necessarily oppose the more conventional model of acoustical research—and indeed, in a historical sense, developed alongside it—sound maps are important for entirely different reasons. Most immediately, they empower an approach to the study of environmental sound that is based on experience and perception, one that resists being "closed" either to further analysis or to the insights of subjective experience.

With this theoretical framework in place, the remaining chapters of this dissertation turn to more tangible analysis. In the next chapter, I will explore some of the problems inherent to visualizing the urban sound environment. As government regulators, artists, scholars, and the wider public have come to appreciate the constructive role that sound plays in everyday life, they have increasingly relied on spatial graphics purporting to "show" sound: perhaps by circumscribing a sonic territory, or by identifying points of specifically sonic interest. In addition to proposing a general typology that can be used to study environmental sound maps, I will work to disentangle some of their visual elements from the design and analytical methodologies used to construct them.

Chapter 2: A Typology for Environmental Sound Maps

To give a totally convincing image of a soundscape would involve extraordinary skill and
patience: thousands of recordings would have to be made; tens of thousands of
measurements would have to be taken; and a new notation would have to be devised.
—R. Murray Schafer, *The Vancouver Soundscape*

Introduction

In the first chapter of this dissertation, I worked to theorize the development of the

sound map. I suggested its conceptual roots can be found among the work of Wallace

Sabine, a physicist at Harvard, who made use of visual representations to demonstrate the

movement and flow of sound, its fluctuations and variations, even within a single and

highly controlled environment. I further proposed that these images suggest a different

way of engaging with the world: a new sonic consciousness, where sound is valued not

for its ability to be contained—or in fact, to exert control over us—but rather for its

tendency to change as it moves and flows, decays or intensifies, through space.

Since the early days of the 20th century, sound maps like these have found their way

into a number of different fields of inquiry. Indeed, as scientists, sound studies scholars,

government regulators, musicians, and even visual artists have developed an interest in

the dynamic, sensorial textures of daily life, maps have increasingly become a

representational medium of choice. Convenient and often visually compelling, sound

maps can be found with regularity throughout both academic publications and regulatory

documents today. And yet, very little has been written about them. Of the small number

of articles dedicated to their study, none shed critical or analytical light on what sound

maps show and how.[1] The purpose of this chapter, then, is to expand the potential for academic dialogue by sketching a general sound map typology, one that can be used to disentangle the image of the map from the underlying methodology used to construct it

The typology outlined here is meant to help clarify how the "texture" of audible space is both presented and represented, transformed and transferred, into a medium that, in other contexts, might not seem suitable. Each section below, except "Thematic Words," will therefore define and discuss a particular sound map type: the first section explores grid maps; the second explores field maps; the third section explores soundwalk maps; the fourth explores territory maps; and the fifth and final section explores dynamic, internet-based maps. While each type can be distinguished based on several key methodological and visual considerations, there are nonetheless a few shared technical and optical similarities among them. For this reason, they will be sub-labeled according to the other types which bear some resemblance.

Thematic Words

Before delving too deeply into the sound map typology, it is perhaps worth explaining why this kind of typology is useful in the first place. Despite their relative historical newness, there is nothing particularly "new" in the conceptual or visual operations of a sound map. As cartographer and historian Arthur H. Robinson has written, where "general cartography" describes maps meant to "locate and identify geographical

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1 Jacqueline Waldock, "Soundmapping: Critiques and Reflections on this New Publicly Engaging Medium," *Journal of Sonic Studies* 1, no. 1 (October 2011), http://journal.sonicstudies.org/vol01/nr01/a08 (accessed 23 April 2012); Solène Marry, "Assessment of Urban Soundscapes," *Organised Sound* 16, no. 3 (2011): 245-255; Olivier Balaÿ, "Discrete mapping of urban soundscapes," translated by Harry Forster, *Soundscape: The Journal of Acoustic Ecology* 5, no. 1 (Spring/Summer 2004): 13-14.

features,"[2] maps of sound belong to a derivative practice known as "thematic

cartography." Robinson finds thematic cartography expressed with particular clarity in

maps

> showing the geographical occurrence and variation of a single phenomenon, or at
> most a very few. Instead of having as its primary function the display of the relative
> locations of a variety of different features, the pure thematic map focuses on the
> differences from place to place of one class of feature ... The number of possible
> themes is nearly unlimited and ranges over the whole gamut of man's interests in the
> present and past physical, social, and economic world, from geology to religion, and
> from population to disease.[3]

In more general terms, thematic cartography has a relatively simple function: to

transform a set of (often empirical) information—about population or poverty,

precipitation or the position of armies—into a series of graphical marks, whose variations

in size, shape, contour, quantity, or color correspond with a perceived or material change

in the represented theme. Ultimately, this is done with the "hope of discovering

meaningful correlations among the regional variations."[4] Thematic maps can therefore be

understood as heuristics of a sort, useful because they help us discover new and different

ways to sort through what may otherwise seem like random or unrelated observations

about the world.

Thematic cartography initially came to prominence during the early 19th century

coincident with the rise of strong imperial governments—a consequence of the practical

need to study the languages, activities, and movements of diverse peoples. But it was

industrialism, the rise of capitalism, and rapid population growth in industrialized

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[2] Arthur H. Robinson, *Early Thematic Mapping in the History of Cartography* (Chicago and London: University of Chicago Press, 1982), 16.

[3] Ibid.

[4] Ibid., 155.

countries that lent these maps sudden importance.[5] They were tools that could be used to study people: the health of their bodies, the movement of the goods sustaining them, and the spread of the maladies afflicting them. According to Robinson, "[t]he sharp rise" in the use of thematic cartography during the first half of the 19th century represents "the combined effects of greatly increased curiosity about the earth and man and numerous innovations in the techniques and conceptual aspects of mapping." It was also during this time that "almost all the symbolism used in thematic mapping today was devised and put to use."[6]

Since representing abstract topics such as the spread of urban disease was beyond the technical limits of "general" cartography, it is perhaps not surprising to find that new and different kinds of representational media developed alongside thematic maps. Where contours (also called isolines) have very early origins, dating to the work of Pieter Bruinsz in the late 16th century,[7] dots and points were not used in thematic contexts until much later, in 1837, when they were shown the relative population size of cities and towns in Ireland.[8] Other maps—like flow maps, which use lines or arrows of varying length and thickness to show the intensity or volume of movement from place to place— did not appear until the early 19th century, when they were used in maps by Henry

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[5] Ibid., 155.

[6] Ibid., 219.

[7] Ibid., 210-11.

[8] Ibid., 199.

Harness (UK), Charles Minard (France), and Alphonse Belbair (Belgium) to compare

economic data and the flow of goods in Europe.[9]

But behind each development in representation lie also advancements in

technology, especially printing and engraving. Robinson explains how "the proliferation

of duplicating methods in the nineteenth century, especially lithography, had a great

influence" on what themes could be shown and how.[10] Lithography, of course, was itself

developed in the late 18th century as a relatively quick and cost-effective printing

method. It involves using hydrophilic and hydrophobic substances to mediate the transfer

of ink from one surface (historically limestone) to another (paper). Lithography was

especially appealing to thematic mapmakers because it provided an efficient means to

layer topical content on top of an already-extant map. Alternative approaches, conversely,

were seen as risky and potentially expensive by comparison since a single mistake in a

single thematic detail might require making an entirely new die. With copper engraving,

for instance, thematic information could only be introduced on the original surface with

"numerous flicks with a sharp tool, by using a punch and hammer to make dots, or by

using a variety of rough-surfaced rollers, rockers, and roulettes which would produce a

pattern of indentations."[11] Given the ease with which printed maps could be edited and

corrected, the likelihood of error meant copper engraving was ultimately abandoned in

favor of the simpler and less costly methods like lithography.

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[9] Ibid., 147.

[10] Ibid., 193.

[11] Ibid., 194.

It is important to remember, however, that as soon as the process of selecting

thematic information for display begins, we have already done much more than present

"an innocent 'reality', somehow dictated by the intrinsic 'truth' or by 'facts' in the

data."[12] From Google maps to weather maps, viewers are conditioned to see the image as

itself a true depiction—a representation of the world "as it is." Indeed, a naive approach

to cartographic analysis would have us accept that a map, thematic or not, shows exactly

what it claims. Cartographic historian J.B. Harley goes so far as to call this the "uncritical

adoption" of thematic cartography and suggests that its prevailing impact can be "linked

to two main sets of influences."

> The first is the belief that mapping is merely a technical or methodological strategy
> rather than a discourse ... The second is that the sometimes strident claim by
> cartographers, that they had devised a technical solution to the representation of
> data, was taken at face value. The result was an elevation of the map so that we
> were often mesmerized by its mimetic powers.[13]

Of course, in some respects, the introduction of thematic material may seem to mitigate

the need for critical analysis, since it goes almost without saying that giant isolines or

arrows do not actually exist and are merely visual and conceptual abstractions. But

Harley and fellow historian John Pickles suggest the opposite is true. All maps, even

thematic varieties, must be seen and read as culturally, historically, and even politically

determined. It is their very nature to conceal that choices were made about what to show

and how—choices which can, in turn, shape and influence how we understand the world

they are supposed represent. Echoing Foucault, Pickles explains how maps are

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[12] J.B. Harley, "Historical geography and the cartographic illusion," *Journal of Historical Geography* 15, no. 1 (January 1989), 86.

[13] Ibid., 83.

always an *argument* ... and it is patently wrong to present them as a hard 'truth', or to deny their indeterminacy of meaning. In historical geography they force a particular reading of reality by suppressing other aspects of the past. They are full of silences.[14]

Whether designed as wartime propaganda or as an aid to navigation,[15] maps always do more than merely represent simple reality—or, as Žižek more accurately explains, "the symbolic coordinates which determine what we experience as reality."[16] Maps, that is to say, represent and reproduce a network of power relations, social tensions, and cultural norms.[17] And as Pickles explains,

> [b]y not paying sufficient attention to their own crafty skills of transmutation and by tirelessly seeking to turn away from the interpretative nature of their Merlinesque constructions, scientific cartographers have found it very difficult to explain the difference between their own magic and the conjuring tricks of those who would use this magic for militaristic, propagandistic, or commercial ends. By making scientific cartography into a technical enterprise and rejecting (or overlooking) its magical and hermeneutical practices, cartographers have grappled with the error and distortion in only technical terms.[18]

And yet, the "Merlinesque constructions" of sound maps—where spatial and sonic representations merge into a single frame—have not received any serious critical attention. Nowhere in the scholarly literature today is there any meaningful discussion of what they show and why: which sounds have been chosen for representation, and which, as Pickles suggests, have become "silences." Because they are more than merely a

[14] John Pickles, *A History of Spaces: Cartographic reason, mapping and the geo-coded world* (London and New York: Routledge, 2004), 86.

[15] Pickles, 37-38.

[16] Slavoj Žižek, "Welcome to the Desert of the Real," in *The Symptom* 2 (Spring 2002), http://www.lacan.com/desertsymf.htm (accessed 27 September 2011).

[17] Ibid., 37-47. Additionally, Pickles asks "[w]hat ... can we say about maps such as those that represent the 'earth from the South' or 'the Australian's view of the world'? In such maps, the techniques of modern cartography ... are used to dislodge a particular hegemonic orientation that has been standardized historically." (Pickles, *A History of Spaces,* 45.)

[18] Ibid., 45-46.

"technical enterprise," it is my contention that sound maps should be scrutinized in more detail, paying special attention to the relationships that bridge their methodological and visual form to the surrounding cultural and political milieu. The remainder of this chapter will therefore define five sound map types whose characteristics are designed to facilitate further critique.

Type One: Grid maps, becoming fields

The first sound map type is the grid. Though comparatively rare, grid maps can be defined as those which emplace empirically-derived sound observations, acquired either by human or mechanical means, in a regular pattern across the surface of a base map.[19] These maps depend on the careful observation of sound at specifically-designated points, but what makes them distinctive is the textural consistency of the final result. In these maps, the grid rules: rather than being guided by sites deemed important or meaningful to acculturated listeners, the grid provides an indifferent framework upon which the final (though not always literal) image is assembled.

London and its boroughs provide an interesting opportunity to observe the origins of the grid map. Its developmental roots can be traced to a report published in 1968, titled *The London Noise Survey* (LNS), which set out to "sample noise in as representative a way as possible."[20] It consequently consisted of two discrete but interlocking parts, distinguished principally by methodology. The first was an "objective survey" carried out

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[19] A "base map" refers to a spatial diagram onto which thematic content is layered. For a brief discussion, see: Robinson, *Early Thematic Mapping*, 17- 22. For more recent developments, see: Alison Sant, "Redefining the Basemap," *Intelligent Agent* 6, no. 2 (2006) http://www.intelligentagent.com/archive/Vol6_No2_interactive_city_sant.htm (accessed 16 January 2010).

[20] Building Research Station, Ministry of Public Building and Works, *London Noise Survey* (Her Majesty's Stationery Office: London, 1968), 3.

by the Building Research Station (BRS).[21] Their task was to record, catalog, measure,

and graph the sounds that *can* be heard throughout the city—"to assess noise of all kinds

present"[22]—without regard for whether these sounds *are* heard.[23] The second part,

executed by Government Social Survey (GSS), was a "subjective survey" meant to "set

noise in perspective with other factors, and to ascertain the relative effects on daily living

of indoor and outdoor noise."[24] Because the GSS component was conducted in the

abstract—drawing on statistical and demographic surveys, not addressing spatial location

or the direct observation of sound—it is perhaps unsurprising their report made no use of

maps at all. The BRS team did, however, and quite extensively.

Mapping sound at the urban scale presents some obvious, if not forbidding,

challenges; and indeed, it became clear early on that there were very real limitations on

what the BRS team could hope to accomplish. There arose, then, a need to understand

precisely how much sonic information would need to be collected, and to what extent

statistical samples could be used to fill in the gaps. For this, they arranged to conduct a

pilot survey in the London borough of Watford, where they experimented with any

number of equipment settings and orientations: different microphones, different ways of

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[21] Ibid., 1.

[22] Ibid., 3. The word "assess" here seems somewhat inaccurate, because it seems to imply "valuation." In all, their project seemed much less interested in labeling sounds as good or bad, but simply observing them, trying to understand how they influenced various parts of the city.

[23] This phraseology may coy, but it is important. Barry Truax has written that overlooking un-heard sounds is a crucial error—a syndrome he calls the "ear versus the body syndrome." He explains how "this syndrome ignores the fundamental fact that sound is first and foremost a *physical* vibration that affects the whole body. For instance, the body contains many enclosed spaces or cavities that can resonate sympathetically to vibration, each at its own frequency." See: Barry Truax, *Acoustic Communication* (Westport, CT: Ablex Publishing, 2001), 98.

[24] Ibid., 1, 59.

connecting microphones to (one or more) tape reels, different ways to calculate the loudness of sound, different heights and directions to place microphones, the usefulness and accuracy of different recording profiles (e.g. dBA, dBC), different sampling techniques, and so forth.[25]

After a careful review, the BRS team determined that recording for 24 continuous hours was both impractical and unnecessary; strategically acquired samples were deemed equally sufficient. Specifically, they determined a two-minute sound recording, captured once every hour for twenty four continuous hours, provided a representative cross-section of the kinds, qualities, and intensities of sound heard at each location. In addition, they narrowed the scope of the survey to the traditional workweek, since it was observed that the disruptive capacity of "unwanted sound" was most acute on weekdays when both economic and travel activity is highest.[26] While the "method of sampling" the BRS proposed was novel and "had not been used in previous surveys," they nonetheless determined it would be the "least biased" approach to studying urban noise.[27]

The decision to structure the survey around strategic samples meant the LNS team had at least two crucial decisions to make: the first was to determine where to place the recording equipment; the second was to determine how many sites would need to be surveyed. They explained:

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[25] Ibid., 3.

[26] Ibid.

[27] Ibid. It is important to mention that the BRS found recording sound for more than a 45-50 minute period was difficult for "practical reasons." Although they do not specify what these reasons were, it is reasonable to assume the sheer quantity of tape reel required for that duration presented some obstacles, as did the number of man hours required to analyze them.

On practical grounds it was thought that a representative survey of this nature would take about a year, and with two sets of measuring apparatus, either about 500 points could be sampled for one complete day each, or a lesser number for a proportionately longer period of time.[28]

The pilot survey in Watford suggested something else. On one hand, a close spacing of microphones, at 250 yards, gave a "relatively accurate picture" of the sounds in any particular place; but since noise levels, especially those in residential areas, tend to be lower overall, the BRS team determined microphones could be spaced at twice that distance.[29] As a result, the survey was quite literally framed by an abstract grid, one with lines spaced at 500 yards apart. A recording van containing all the necessary equipment (microphone, tape reel, etc.) was then parked at each of the 540 points in real space where grid lines intersected. (Figure 2-1) Once in place, a pair of microphones would be deployed—usually on top of the recording van, or otherwise on a microphone stand raised to the equivalent height.[30] Where the presence of water, train tracks, or some other obstruction meant a particular point could not be reached, the survey equipment was positioned nearby, perhaps on a bridge or riverbank.[31] All of the relevant information—

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[28] Ibid.

[29] Ibid., 3-4. Further technical accommodations were made for the microphones. They explain: "[T]he Watford pilot survey had shown that the range of noise levels to be expected was greater than the dynamic range of any of the normal tape recorders used for recording. The full pass noise levels were likely to range from 30dB in a quiet location at night to over 90dB adjacent to a particularly noisy vehicle. To deal with this range of noise levels the signal from the amplifier was split to feed both channels of the tape recorder which had amplifications set to differing by 20dB. [sic] Since the crosstalk between adjacent channels was better than 30dB and the dynamic range of each channel 50dB, the quieter noises, from 30 to 80dB could be recorded on one channel and the louder 50-100dB, on the other."

[30] Ibid., 4.

[31] Ibid.

including the location of the van, tape reference numbers, and the address of the person

providing access to electricity—was later copied onto a simple report form. (Figure 2-2)

After a recording cycle was completed, all of the results would be analyzed and

subsequently transferred onto a separate report form featuring a selection of qualitative

(e.g. "people talking") and quantitative (e.g. "40 dB") information. (Figure 2-3) The final

LNS report, published in 1968, included 54 of these forms, 10% of the total number.

Each entry shows a small street map on one side and a 24 hour graph on the other, the

latter showing both the average "high" and the average "low" decibel reading for each

area at any given hour of the day. It is important to note, however, that there was no

incremental decibel penalty for sounds produced at night—justified in more recent

surveys because the lack of ambient background sound makes even moderately disruptive

noise seem more intense at night than an empirical reading might suggest.[32] Here,

instead, decibel levels were graphed exactly as they were recorded; and what emerged

was a striking (though not surprising) rhythm: decibel readings are uniformly higher

during the morning and evening rush hours, with the deepest lull occurring just before

dawn.

Many such small decisions made by the LNS team were formative. For instance,

the grid, whose structure was shaped by technical or human limitations—the capabilities

of a pair of microphones or the capacity of a careful listener, for example—quickly

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[32] In acoustics research, this statistical model is called L_{dn}. It is designed to show the average decibel reading for a given location, with a 10dB penalty for nighttime sounds. The results are calculated according to the formula $L_{dn} = 10 \log \{1/24 \, [15(10 \, L_d/10) + 9(10 \, L_n+10) \, 10]\}$ where L_d is the equivalent noise level during the day, and L_n is the equivalent noise level during the night. Of course, this is one of a number of different statistical models—others include perceived noise level (PNL), noise exposure forecast (NEF)—which do not usually include such penalties.

became much more: a literal, methodological construct. (Fig. 2-1) That is to say, not only

did the grid help narrow the ambitious breadth of the study, but the sampling method,

which informed the grid's size, meant sonic noise could be studied without an excess of

data noise. But the grid had other impacts, too. As the BRS team was aware, it also

limited the kind of maps they could hope to make. They wrote, for instance:

> it is obvious that measurements at points spaced 500 yards apart do not enable
> noise contours to be drawn on a map. A very much closer spacing of the points would
> have been necessary for this, resulting in a smaller area or a number of smaller
> areas being surveyed in greater detail. The results ... would not be representative of
> other positions except where these were virtually identical with regard to the noise
> sources, distances, and size of adjacent buildings.[33]

This process—observing sound, collating, then generalizing the results—almost

precisely explains how the LNS report forms interact with the underlying grid. Each point

contributes more to the study than what might seem obvious: rather than simply locating

where a sound recording was taken, it links or embeds a specific sonic rhythm to a

specific point. Sound, as a result, becomes deeply implicated within the frame and,

furthermore, begins to spread and proliferate across the surface of the map. Indeed, the

LNS even anticipated the possibility that readers would sift through each diagram to find

one whose mix of housing, park, office, and industrial use is "virtually identical" to their

own—and from there, extrapolate conclusions about the local soundscape. So, what seem

like isolated dots on narrowly-contained maps begin to spread; and as a result,

cartographic space is transformed: rather than being implicitly silent, the map comes to

represent a place already woven-through with sound, though articulated only at a few key

points.

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[33] Ibid., 11.

This is an unusual thing for a grid to do. After all, grids are most commonly used to impose a stable and rational framework: in perspective drawing, to create a series of smaller, contained areas that can each be studied manageably; in mathematics, the Cartesian grid is used to articulate points only when underlying data calls for it.[34] The transformation and development of the grid in the LNS is therefore significant in itself. Here, however, the grid functions as an implicit set of instructions: each point has to be visited, listened-to, measured, and analyzed, then spread and proliferated across the surface. If not, the sonic fabric would lack crucial threads, the image would be incomplete. Still, the LNS grid only achieves this effect through implication. There is no large-scale map published where all of the data is recombined, collaged into a single frame. That work, instead, is left for the viewer or analyst to perform. It is by making connections between and among measured locations, by noticing patterns, that the broader image of the survey begins to emerge.

Not all grid maps leave open this act of recombination. A quite sophisticated example can be found decades after the LNS was completed. The Twin Cities Design Festival in 2003 saw the release of nine innovative "knowledge maps." Each was designed to challenge the viewer to think about the city of Minneapolis differently—to help us better understand what transforms "space," its physical dimensions and material parts, into "place," a living, breathing environment, filled with meaning. Some maps did this by focusing on what was tangible and useful in the city, though perhaps underutilized, like the location of urban gardens. One map, though, took a completely

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[34] Hannah Higgins, *The Grid Book* (Cambridge, MA: The MIT Press, 2009).

different approach. Rather than showing the city as someplace physical, a space filled

with "things" that could be used or had, it showed Minneapolis as a sonic space, one that

had been already-sounded.

This map, titled "466 Decibel Readings," was designed by a group of music

students and graphic designers, lead by Rachel Thompson and Jonathan Zorn. It was

made by transposing a series of small icons onto a minimalist rendering of the city's most

well-known geographical features: the highway system, the airport, and the Mississippi

river—all unlabeled. The result took the form of a grid, articulated by a small image,

located at each point of intersection. (Figure 2-4) While Zorn explains that the idea to

map Minneapolis using the grid came early in the design process, actually collecting the

measurements at each point posed a number of significant challenges. After all, the

location where each grid line intersected was determined ostensibly externally—

regardless of how difficult that point would be to reach and without any consideration for

the kinds and types of sound that would be heard there. Zorn recalls:

> We all ended up in places that we had never been before, situations where we
> weren't sure just how much we should follow the grid. Is it trespassing? How do you
> measure the db in the middle of the interstate? Are the giant carp going to jump out
> the river and attack me, and so on. It was a fun way to get to know the city.
> ...
> Often people would come up and ask what we were doing. We would explain the
> project and encourage them to submit stories of sonic experiences in the cities.
> Sometimes people would just assume that we were up to no good. I overheard one
> father daughter interaction after they walked by me. "Daddy what are they doing?"
> "Asking for money, fucking canvasers."[35]

The grid itself, though, was planned quite casually. Zorn joked that the design team used

"something really scientific, like putting a ruler on a big map and checking off every inch

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[35] Jonathan Zorn, interview by author, questionnaire sent and received by email, Charlottesville, VA, 11 August 2010.

or so."[36] The measurements they collected, on the other hand, were taken with a great

deal of care. For each location, a line on a report form was completed, featuring: the date

of observation, the corresponding (mapped) reference point, a geographic description of

the location (e.g. "35th Ave + Senbury Ave"), and six discrete decibel readings acquired

using low-tech hand-held equipment. This data was later averaged, and the result formed

the basis for a small circular icon—showing a decibel reading in the center and a

corresponding number of thin, concentric circles surrounding it. (Figure 2-5) After all of

the readings had been taken, and all of the icons constructed, each of the final 466

readings was returned to the surface of the base map, superimposed on top of the

unlabeled city in a way that preserved the grid's original form.

What emerges, visually, is akin to a sonic fabric knitted across the surface, an

experiential and sonic topography that would be otherwise difficult to imagine. But there

is also a more superficial element to this map. Not only does it open sounded-space for

the imagination to dwell in, it is, more simply, interesting and compelling to look at. "466

Decibel Readings" deftly balances abstraction with familiarity, detail with imprecision,

regularity with apparent randomness. The simplicity of each icon is complicated by their

subtle differences: the lines surrounding each number are easy to miscount; the increase

or decrease in the number itself is easy to overlook; sudden changes in the decibel

reading sometimes occur without any indication as to the cause. The result, textured but

still clearly articulated, reveals a kind of aural regularity that exists both in spite and

because of the sonic variations observed at each point.

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[36] Ibid.

This fascinating perspective on life in Minneapolis—a textured sound grid—

seemed to momentarily capture the imagination of the general public, museum curators,

and the news media alike.[37] During a 2003 interview on National Public Radio, Rachel

Thompson speculated about some of the aims and intentions behind making it:

> Perhaps what we were trying to do with the project is suggest a different point of
> entry for visitors to the city, or a different way for residents of the cities to reconsider
> how they navigate or how they experience their city on a daily basis.[38]

What Thompson says here is crucial, because even though "466 Decibel Readings"

typifies an advanced and certainly visually compelling grid, it highlights the vague and

slippery point at which the grid itself begins to dissolve: the point at which we, as

auditors, begin to notice that what we hear "on a daily basis" shapes the content of our

lives and the identity of our community. What begins, then, as a tightly-woven and

clearly-structured frame becomes an object intertwined with ordinary life—one sensitive

to an experience of place, the sounds (present and past, audible and remembered)

understood to define it.

Type Two: Field maps, becoming walks and territories

A second type of sound map is the field map. Generally quite common, especially

in disciplines like acoustic ecology and anthropology, field maps can be defined as those

which link either subjective or empirical sound data to the life and activities of a

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[37] "466 Decibel Readings" was featured prominently in art exhibit, "Sense of the City," held in 2005 at the Canadian Centre for Architecture in Montreal, Canada. Photographs of the exhibit, along with reflective and analytical essays, are featured in the published guide. See: Mirko Zardini, *Sense of the City: An Alternate Approach to Urbanism* (Montréal: Canadian Centre for Architecture, 2005).

[38] "Map Marks Hot Spots in Twin Cities," interview with Robert Siegal and Rachel Thompson, *All Things Considered,* National Public Radio, 3 September 2003.

particular community. As a result, field maps take any number of visual forms: they

might have arrows, representing the approach of incoming sounds; they might include

sound contours, suggesting different thresholds of perception; they might also locate a

significant sound within a community, identifying where it can be heard or the object

making it.

A wealth of field maps can be found in the published work of the World

Soundscape Project (WSP), a consortium of scholars and sound artists based at Simon

Fraser University whose work was discussed in the introduction to this dissertation.

Specifically, this is where maps—what Schafer refers to as "notation"—become

important. "To give a totally convincing image of a soundscape," he wrote "would

involve extraordinary skill and patience: thousands of recordings would have to be made;

tens of thousands of measurements would have to be taken; and a new notation would

have to be devised."[39] The first WSP publication to make use of this "new notation"—

which included maps—was *The Vancouver Soundscape* (TVS), published in 1978.

Compared to the BRS component of the LNS, or even "466 Decibel Readings," this study

approached environmental sound in a far more supple way. The WSP did not, for

instance, have a uniform plan for stationing recording vans throughout the city, nor did

they have a rigorous scientific approach aimed at creating statistical models. Instead, their

analysis was grounded both in their own experience, living, moving, and listening to

Vancouver, and the experience of other residents. To aid their study, the team developed

three broad categories of ambient sound: "keynote" sounds, those that compose the city's

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[39] Ibid., 28.

background structure—the hum or buzz of ambient space; "signals" sounds, usually instructional or performative, like a bell that calls people to church, or a whistle that calls them back from lunch break; and "sound marks," sounds which are in some way unique to the community and help to define its character—though in a more literal sense, they may be "signals," too: a particular church bell, a specific factory whistle.

While the WSP mapped many sounds in all three categories, relevant here is less what they mapped than how they mapped it. On one map, for instance, the WSP identifies a number of significant sounds throughout Vancouver harbor: foghorns, the time gun, church bells at the Holy Rosary Cathedral. (Figure 2-6) Not only is the spatial location of each sound identified, but the sound is itself represented iconographically, by a small image representing the thing producing it. This is a metaphorical, almost hieroglyphic form of notation, one where the sound of horns *becomes* horns; the sound of bells *becomes* a bell. And in this respect, something relatively complex happens here; the map allows Vancouver to be literally seen in terms of the complexity and richness of sound experienced there.

Of course, transforming a thing or place into a small graphic is not uncommon in thematic cartography. Similar examples can be found on tourist maps of London or Washington, D.C., where monuments and museums are turned into small symbols. Maps like these, however, are important beyond their simple transformations. In choosing to show some places rather than others—and indeed, using one symbol rather than another —they can provide insight into what a community deems valuable: perhaps what it needs to find (e.g. a train), whom it chooses to memorialize (e.g. a great person), or what

aspects of a particular location are worth noting (e.g. an important building, a government ministry). But the harbor map of Vancouver adds an extra layer of complexity to this calculus, since what is being located is not a service or a thing, but rather an event or experience—a sound—whose conscious hearing depends on an interdependent network of actors: human operator + fog horn + foggy weather + wind direction + shipping traffic + free trade agreements, etc. Without each fully in place, there would be no horn sound, no horn, and no map. The image we see, then, does more than simply show a "sound mark." It shows a whole field of relations.

Another important development in TVS is the use of maps that locate non-audible sounds: sounds, in other words, that require some form of technological mediation in order to become audible. One memorable example identifies the varying pitch level of telephone dial tones found throughout the Vancouver metropolitan area. (Figure 2-7) This map was composed using a peculiar mix of notational schemes including traditional musical staff. While the map does not delineate clear boundaries for each pitch community, it nonetheless suggests that, if a telephone user somewhere in North Vancouver hears an "f" when they pick up the phone, someone to the southwest, perhaps in Kitsilano, will hear a flat "a," and someone calling from the east, somewhere in Port Moody, will hear a "g#."[40]

A similarly imaginative map is constructed to show the broadcast range of local radio stations. (Figure 2-8) Of course, radio signals are not themselves sound but more exactly electromagnetic waves operating in the sub-visual spectrum. These waves can be

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[40] Ibid., 41-42.

transmitted in one of two ways—by varying amplitude (AM), or by varying frequency

(FM); but in either case, the result cannot be heard without the assistance of a receiver

and amplifier. The WSP ordinarily calls these sounds "schizophonic"[41]—sounds

transmitted away from their source by electronic means. Nevertheless, in this map, they

are treated as any other ordinarily-audible sound: one that builds and reinforces a sense of

community, and at the same time, one that is highly contingent and variable from place to

place.[42] The resulting map becomes a peculiar kind of Venn diagram—one showing how

small variations in position, elevation, or location can make the difference between being

included or excluded from the sonic field.

A similarly rich and diverse cache of field maps can be found in another significant

WSP publication, *Five Village Soundscapes* (FVS). Here, the WSP team traveled to

Europe to "enquire into the different types, quantities and rhythms of sound heard in five

villages in five countries, and to show the relationship of these sounds to the structure of

each village and its life."[43] One of their principal goals was to understand how the sonic

environment worked before now-familiar sounds—especially those of aircraft and cars—

came to dominate urban life. For that reason, it was necessary to study towns and villages

whose economic and social structures more closely resembled those common during the

19th century: each had fewer than 3,000 residents, and each had a defined economic and

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[41] Ibid., 41. "We call telephones and radios schizophonic, meaning that they split sounds apart from their original sources to transmit elsewhere. Like the related word 'schizophrenia,' we want schizophonia to have a nervous ring, for while the benefits such developments bestow are well enough known, we do not want to forget that they are contributing to the overpopulation of the soundscape." (41)

[42] Ibid., 44-46.

[43] R. Murray Schafer, ed. *Five Village Soundscapes* (Vancouver: A.R.C. Publications, 1977), 1.

social framework. Dollar, Scotland, for instance, is known for its primary school, while

Bissingen, Germany is known for its rich agricultural life, and Lesconil, France for its

fishing economy.

While each soundscape was just as intricate and complex as Vancouver's, the

relatively small size of each village meant it could be studied in more depth and detail.

The WSP team was able to investigate, for instance, how different groups of people living

in each area understood and experienced their local soundscape. One important

observation they made was that a village's identity is often shaped by "old" sounds—not

in the sense of decayed or inaudible, but sounds that were long associated with a

particular place, even if that sound has long since been "masked"[44] by a general rise in

ambient noise.[45] In Bissingen, they observed that the church bell, which in previous years

had been considered a community sound mark, had lost much of its meaning for younger

residents. This, they speculated, "may be explicable as a function of the rise of ambient

noise."

> As the countryside becomes noisier ... sounds do not travel as far ... as they cease,
> [the younger generations] no longer hear the bells, or, as we were informed in

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[44] In the *Handbook for Acoustic Ecology*, Barry Truax defines masking as "[t]he effect one sound has on another by making it harder to impossible to hear. The level of masking can be defined in decibels as the threshold shift necessary to restore a masked sound to audibility in the presence of a masking sound." See: Barry Truax, *Handbook for Acoustic Ecology* [CD-ROM] (Vancouver: Cambridge Street Publishing, 1999).

Jean-François Augoyard and Henry Torgue add that "[t]he mask (*masque*) effect ... implies a subjective psychophysiological reaction: the masking sound can be judged as either parasitic or favourable, depending on whether or not the masked sound is perceived as pleasant." See: Jean-François Augoyard and Henry Torgue, eds. *Sonic Experience: A Guide to Everyday Sounds,* translated by Andra McCartney and David Paquette (Montreal and London: McGill-Queen's University Press, 2006), 66.

[45] Schafer, *Five Village Soundscapes,* 15.

several German cities, they begin to experience them as a source of irritation or noise.[46]

The sound map they used to demonstrate this shrinking sense of community is a fascinating mishmash of remembered and empirically-observed sound, of conceived space and built space. It treats physical objects, like the autobahn and village borders, as constant, while the bell profile is shown quite tentatively—receding behind other objects at various points for no apparent reason. (Figure 2-9)

Other maps in FVS are somewhat more ambitious in their representational aims— and consequently, are not always convincing. One map, for instance, shows the dispersion profile of important sounds in Dollar, including the church bell and the summertime pipe band, while simultaneously showing the movement of external sounds into the village, like the train whistles from Dunfermline and the Old Caledonian Line, or the bleeding of the steam tubes at the power station on Frith of Forth. (Figure 2-10) While this map appears straightforward, the information it presents is actually quite multifaceted. Some of these sounds can be heard in the present, while others are not only inaudible, but figments of psychoacoustic memory; some sounds are part of everyday life, while others were jarring, one-time events (e.g. "Quarry Explosion 1951"); some sounds are shown circumscribed, as if contained, while others are shown advancing, moving-in on the village and its residents. Sound, or things that make it, are shown variously as sustained or intermittent, predictable or unpredictable, enjoyable or bothersome, informative, instructive, or deadly. The criss-crossing of lines and contours

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[46] Ibid.

furthermore lend this map a sense of dynamism and motion, reflecting the complex

interaction among sounds produced both by the community and the world outside.

A similarly complicated map from Skruv "shows the different physical areas

encompassed by the signal sounds of Skruv."[47] (Figure 2-11) But this map is also used by

the WSP to expose some rather odd disjunctions in the way local residents perceive their

environment. They explain how

> [t]he measured sound levels suggest that the brewery shift whistle ought to have the
> largest profile, yet the acoustically less powerful church bells are defined by the
> villagers as spreading over a greater area. They think the bells reach farther, based
> presumably on what they have 'noticed,' but in fact this reach of the bells is probably
> largely a mental process that reflects the cultural values associated with the sound.
> Another factor could be that the church bells have a more complex pattern: they ring
> repeatedly and have more internal structure than does the single blast of the shift
> whistle. Also, the bells ring only once a week, on Sunday, when it is quieter.[48]

Perhaps nowhere else in the WSP literature does the gap between sound as it is perceived

and measured come into such sharp relief. And the map plays a crucial role in doing it, by

showing how drastically out of sync these assessments are. While an accompanying

graph provides extra empirical detail, the lines on the map do not themselves represent

decibel contours. They are instead "estimates" of each sound's profile—a phrasing which

highlights, if nothing else, the contingency both of the map and of memory.[49]

Not all of the WSP maps are quite so compelling; indeed, if one principle of

thematic cartography is that "more" information is not necessarily "better," then the

"Solar Wind Cycle and Sound" map of Lesconil, France is a case study in how much is

too much. Arguably the most baffling map published in FVS, it commingles temporal,

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[47] Ibid., 50.

[48] Ibid.

[49] Ibid., 51.

spatial, and sonic information within a single diagram. (Figure 2-12) Not only is the

periodic time guide unequal, but the arrows—do they represent wind? do they represent

movement?—are left unlabeled.

Overall, however, the WSP maps must be counted among the most significant

collection of sound maps anywhere in published literature. They furthermore constitute

an especially important group of field maps, defined by the way in which they embrace

experienced and represented complexity, the ambivalence of symbols, the depth and

diversity of everyday life. Very often, something is left incomplete—a strange symbol, a

partial contour line, an unexpected reference, an unexpected disclaimer. These gestures

seem to be self-conscious admissions of what Harley and Pickles argued earlier: that

sound can never be fully, completely, or finally "mapped." Just as the larger sound

community is living and changing—composed of memories and experiences *with* sound,

and objects and places that *produce* sound—the map's surface becomes a site where

complexity and contradiction are constantly negotiated. Instead of proposing a

methodologically stable texture, as in grid maps, field maps expose a more messy truth:

that beneath the surface, people are to be met, sounds are to be heard, and experiences are

to be had.

Type Three: (Sound)walk maps, becoming dynamic

Observing the way field maps create tension between what is heard and

experienced leads to a third type of sound map, perhaps the most specialized. The

distinguishing characteristic of walk maps, or alternatively "soundwalk" maps, is the way

in which they coordinate the movement of people between and among sounds of special

interest. So, rather than simply showing the placement of foghorns, bells, or telephone

dial tones, these maps verge on becoming musical notation: they select particular sounds

for audition, and furthermore prescribe a sequence of encounter. They direct us—perhaps

even *intend us*—toward a specific place. At the same time, soundwalk maps ask us to

engage closely with the city, and to listen to its sounds on a deep and conscious level.

To understand what a soundwalk map shows, however, it is important first to

understand what a soundwalk itself is. Though still relatively recent in its development,

soundwalking emerged with special clarity among the writing of WSP scholar and

composer Hildegard Westerkamp. As she explains, soundwalking can be defined as any

activity whose main purpose "is listening to the environment."[50] But here is no specific

requirement that a listener travel to an exotic location to hear something unusual.

> We may be at home, we may be walking across a downtown street, through a park,
> along the beach; we may be sitting in a doctor's office, in a hotel lobby, in a bank; we
> may be shopping in a supermarket, a department store, or a Chinese grocery store;
> we may be standing at the airport, the train station, the bus-stop. Wherever we go we
> will give our ears priority.[51]

Indeed, while this description suggests even walking is optional, should it be included in

the activity, the walk has no particular requirements. Soundwalks can therefore be taken

> ...alone or with a friend (in the latter case the listening experience is more intense
> and can be a lot of fun when one person wears a blindfold and is led by the other). It
> can also be done in small groups, in which case it is always interesting to explore the
> interplay between group listening and individual listening by alternating between
> walking at a distance from or right in the middle of the group. A soundwalk can
> furthermore cover a wide area or it can just centre around one particular place.[52]

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[50] Hildegard Westerkamp, "Soundwalking," *Sound Heritage* 3, no. 4 (1974), http://www.sfu.ca/%7Ewesterka/writings%20page/articles%20pages/soundwalking.html (accessed 12 May 2010).

[51] Ibid.

[52] Ibid.

A soundwalk *map*, then, would seem logically to come later—after some preliminary observations have been made, some experimentation and listening activities already completed. Soundwalk maps involve directed walking, not aimless wandering. Most, in fact, are quite clear about where to go, and often the path to take in order to get there. The fact a soundwalk map is made at all, however, suggests that not all sounds or places are worth hearing; inherently, there must have been some exclusions, some silencing, in the process of making it.

One good example of a soundwalk map can be found in TVS. (Figure 2-13) The base map frames a five-block area between Hastings and Alexander Streets, near downtown Vancouver, on top of which is labeled a series of places (and associated sounds) in the neighborhood nearby. For example, where point number three is clearly marked "Young Iron Works," others are left unlabeled—suggesting, rather than indicating, that something, or perhaps nothing, in that location is worth hearing. What is most crucial about this map, however, is that it provides a specific sequence, a pathway, connecting each point together. An auditor beginning at Main St. and Hastings would proceed on Main toward Alexander St., make a slight detour toward the iron works, double back towards point number two, then turn on Main St. toward the "C.N.R. Station" and the harbor docks.What matters here is not just *that* a certain sound or collection of sounds are important to a community, but that these sounds can, might, or must be heard in a particular order. Soundwalk maps, then—quite unlike grid maps or field maps—are designed to be performed.

Another interesting example, one with quite detailed and vivid instructions, can be

found in Westerkamp's own work. Titled "A Soundwalk in Queen Elizabeth Park in

Vancouver," this map follows the pattern discussed above: it shows specific sites in the

park, numbered according to the sequence of encounter. (Figure 2-14) The explanation

she includes is unusual, however, because it further demonstrates how actualizing the

map must be an active rather than passive process—not only in the sense of the walk, but

in the sounds produced and heard along the way. For example, she writes:

> 3) Close to the fountains you will find a metal sculpture ("Knife Edge" by Henry Moore). Explore it visually as well as acoustically. It consists of two pieces both of which have a different structure. Do they also differ in their sounds? What other relationships can you find between its form and its sounds?
>
> Produce a wide variety of sounds and—among others—try to find a low-pitched rumble, a high-pitched clang, and a swish. You may even like to join together a series of sounds and create a composition (called "Knife Edge ?") Put your ear against the surface and listen to the inside.
>
> 4) When you walk into the conservatory, you are entering an artificially created, tropical environment. Take your time and experience it with all your senses. Does it look and smell and feel tropical? Does it sound tropical? What kinds of birds do you hear? Can you strike up a conversation with some of them? Can you hear the sound of the air-conditioning system?
>
> When you walk across the bamboo-bridge explore it as if it was a sound sculpture. It creates a unique sound which is not generally heard in northern countries. Once you have passed the bamboo bridge listen for the sound of a small waterwheel. In the early days, when the conservatory first opened, it was always running and created a most interesting water soundscape in its vicinity. It is not always audible now and seems to have been neglected as a sound source.[53]

That soundwalk maps would require active engagement in addition to active

listening should not come as a terrible surprise. As a form of spatial-sonic activity,

soundwalking has been described as a creative act in its own right. As Kenny Cuper has

written, walking "transforms the discreteness and separateness of the city into a fluid

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[53] Ibid.

landscape: the city becomes landscape through the walk."[54] The soundwalk, he says, "is not merely goal-oriented and breaks with the automatic pilot mode of perception." It allows the walker "to transform the city into a field of game and chance. By giving over to the city, this city becomes another world."[55] Sound maps mediate this experience by encouraging us to become more aware of the world, teaching us how to listen to it.

The necessity and strictness of the path—how closely it should or must be followed —often remains undetermined on soundwalk maps. So, where the map in TVS recommends both a sequence of sounds and a route to follow, Westerkamp's provides an ordered sequence but no specific path. Both, however, face lingering questions: whether the walker will follow the instructions, whether the instructions can be followed, or indeed, whether anything will be heard if they are. As notation usually goes, there are no absolute guarantees. While it is possible everything notated on the map will be heard, it is equally possible that, through a series of mistakes or wrong turns, nothing will. A soundwalk map followed at midnight, for instance, is unlikely to encounter a working blacksmith.

Recently, however, scholars and artists have taken the idea for a soundwalk in a different direction entirely, transforming it from an active process into an "art piece." One web-based "soundwalk map" made by students at Concordia University in Montréal traces a walking path digitally while an embedded audio track plays a recording of sounds heard along the way. (Figure 2-15) Meanwhile, a slideshow displays photographs

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[54] Kenny Cuper, "Walking as Do-It-Yourself Urbanism," *Goldsmiths Sociology Research Papers* (London: University of London and Kenny Cupers, 2004), 7.

[55] Ibid., 7.

of significant buildings—making the final result something of a "virtual" soundwalk.[56] A

related example, though one without the latest digital trappings, is Annea Lockwood's

"A Sound Map of the Hudson River,"[57] a musical composition which provides "an aural

journey" from Lake Tear of the Clouds to Long Island. As Lockwood herself explains,

because "[e]ach stretch of the Hudson has its own sonic texture," the work performs a

guided tour through and among the various stretches of riverbank. The CD liner notes

feature a map that identifies points of significance along the way. In the end, both

projects articulate the idea for a "soundwalk" or "soundwalk map" in a completely

different way than I mean to discuss it here. Though not always walked—perhaps drifted

or paddled—they are, strictly speaking, representations of a soundwalk *already walked.*

Rather than being active and interactive, the map becomes fixed—technically, if only

technologically, repeatable.

Type Four: Territory maps, becoming dynamic

Territory maps, the fourth type, find sound maps within an institutional or

regulatory environment. As a result, they are concerned, not with the location of sounds

deemed meaningful to a particular community, but rather with the construction of a

standardized view of sounds perceived commonly as unwanted. While the intent of

territory maps is not always misplaced, what makes them worth bracketing as a unique

type is both the legal machinations that surround them and their frequent dependence on

"projected" observation. In Chapter 3, I will critique one particular kind of territory map

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[56] "Montréal Sound Map," http://cessa.music.concordia.ca/soundmap/en/ (accessed 1 February 2010).

[57] Annea Lockwood, *Sound Map of the Hudson River,* Lovely Music, audio compact disc, 1989.

in detail: Part 150 "Noise Exposure Maps," which function as part of an aviation noise program managed by the Federal Aviation Administration. For now, though, it is worth examining the characteristics that define territory maps in general.

A straightforward example of a territory mapping practice can be found in Europe. With the approval of the Fifth Action Programme in February of 1993, the European Community reaffirmed the importance of monitoring and limiting human exposure to noise—defined here as "harmful" rather than merely "unwanted" sound.[58] But this time, the issue was broached not from the perspective of noise as such, but from that of environmental sustainability. Here, "natural resources" were defined in the broadest possible terms to include air; and since noise is, in a strict sense, nothing more than compression waves moving *through* air, it was decided that noise could, in fact, be regulated as a kind of air pollution. Which is to say: if noise had been understood earlier in the century only metaphorically as a kind of dirt, it here became dirt by law.[59]

A more detailed statement, the Green Paper on Noise Policy (COM(96) 540), was approved just over three years later, in November of 1996.[60] But this document had no specific regulatory provisions. As elsewhere, Green Papers in the EU are designed primarily to facilitate a public discussion; and this one in particular presented some startling facts that clarified why a conversation about noise was needed:

> 80 million people suffer from noise levels that scientists and health experts consider to be unacceptable ... an additional 170 million citizens are living in so-called 'gray

[58] "Towards Sustainability," Fifth Action Programme, O.J. C 138/5 1993.

[59] Karin Bijsterveld, *Mechanical Sound: Technology, Culture and Public Problems of Noise in the Twentieth Century* (Cambridge, MA: The MIT Press, 2008).

[60] European Commission, Green Paper on Noise Policy, COM(96) 540, 1996.

areas' where the noise levels are such to cause serious annoyance during the daytime.[61]

Although no specific remedies or sanctions were proposed, the report did identify what it called the leading causes of noise pollution: transportation infrastructure, specifically cars, trains, and aircraft.[62] It furthermore expressed optimism that tangible results, aimed at reducing noise and mitigating its negative impact on the human population, could be reasonably achieved. It notes with praise, for instance, how over the previous twenty years

> noise from individual cars has been reduced by 85% ... and the noise from lorries by 90%. Likewise for aircraft footprint around an airport made by a modern jet has been reduced by a factor of 9 compared to an aircraft with 1970s technology.[63]

While it acknowledged some consensus antinoise remedies can be found throughout the EU already, the Green Paper suggested that continued success depends on a sense of "shared responsibility"—defined here as a uniform system for monitoring and ultimately mitigating the negative impact of noise.[64]

Specific provisos came a few years later in the form of 2002/49/EC, an international directive requiring local governments serving populations greater than

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[61] Ibid.

[62] It is interesting to note how the primary culprits of antinoise policy changed over the intervening 60 years: from gramophones and radios, to public transportation. While the "class bias" Bijsterveld observes in Amsterdam seems less obvious on the surface, and while it is no doubt true that transportation systems are responsible for generating a significant quantity of "unwanted" sound, it is also true that busses and trains are most often used by members of the lower- and middle-classes.

[63] European Commission, Green Paper on Noise Policy, COM(96) 540, 1996.

[64] Ibid.

250,000 people to implement ongoing noise surveys.[65] And perhaps the most visible part of this program was the mandate for all such urban areas to construct "strategic noise maps" to show which parts of the city are most at risk of excessive noise exposure, and furthermore, to identify which sources are most likely responsible. In the United Kingdom, these monitoring and mapping duties were delegated to the Department of Environment, Food, and Rural Affairs (DEFRA), the governing body which remains responsible for studying and regulating pollution of all kinds today. Their first strategic noise map of London was completed in 2006, and in accordance with the EU mandate, was updated beginning in 2011. (Figure 2-16)

The maps created by DEFRA differ in some significant ways from sound map types discussed previously—certainly those of the LNS. For instance, where the BRS team had the power to determine both how and how much information to collect, DEFRA's maps are required to conform to a common set of international standards. While this leaves little room for local ears and preferences—for instance, all of DEFRA's maps concern loudness without providing for the possibility that some "loud" sounds may actually be appreciated or enjoyed—the result has been the birth of an international sound map "semiotics:" a common visual and methodological standard for collecting, studying, and mapping sound. As a result, a map of Glasgow might be quickly and easily compared to one of Munich. Another crucial difference between DEFRA's maps and those of the LNS is accessibility. Where the original LNS study was otherwise a specialist affair, known mostly to scientists, scholars, and government officials, DEFRA's maps of London are

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[65] Commission Directive No. 2002/49, O.J. L 182/12. The European Parliament and the Council of the European Union, Directive 2002/49/EC, relating to the assessment and management of environmental noise, L. 189/12.

meant to be easy to find, easy to read, and easy to understand. They can, in many respects, be seen as an extension of the Green Paper's initial purpose: to facilitate a broad public discussion on questions of noise, the city, and everyday life. Consequently, the maps are widely available on the internet today, viewable from anywhere in the world, searchable by post code.[66] The results can even be filtered to show different aspects or sound, or even to show sound made only by a single source: railway, car, or aviation.

A more significant difference with the LNS, and perhaps a more ominous one, is how the underlying noise information was collected: it wasn't. Presently, all of DEFRA's noise data is derived from statistical models. As a nondescript disclaimer on their website makes clear, no actual sound measurements were made of any location, nor were any decibel measurements taken at any particular place.[67] All of the information used to construct the maps is generated by computer models, which can estimate noise levels by considering the material construction of the surrounding city, nearby transportation activities, the proximity of airports, and so forth.

Computer models like this are commonly used by acoustical engineers, and not without good reason. Roads of a certain size, composed of a certain material, carrying traffic of a certain volume, tend to be associated with decibels levels within a predictable range; neighborhoods located a certain distance away from an airport, whose landing patterns pass within a certain lateral distance and altitude, tend to be subject to a predictable range of aircraft noise. Sound maps created using these techniques are made

[66] Department for Environment, Food, and Rural Affairs, "Noise Mapping England," http://services.defra.gov.uk/wps/portal/noise (accessed 18 January 2013).

[67] Department for Environment, Food, and Rural Affairs, "Noise Mapping England: Frequently Asked Questions," http://services.defra.gov.uk (accessed 2 November 2010).

more by "coding" the city than by "measuring" it: roads, according to the material type and traffic volume; neighborhoods, by their proximity to highways, factories, and waterways. Afterward, the requisite decibel level is applied—without ever having to set foot in any park or sidewalk, for any reason other than to observe the physical materials used in construction, or to count the number of cars and trains passing by.

In a way, this approach shares basic similarities with other, more familiar kinds of thematic mapping, especially maps of weather. Where information such as temperature, humidity, precipitation, and barometric pressure is concerned, meteorologists routinely depend on strategic samples: measurements taken in places where it has special relevance (airports), or which are common points of community reference (city halls or schools). Though certainly not "complete" in the most literal sense, the sampled data points are understood to reflect something of the conditions in the surrounding area. Temperature data, for instance, is not thought to be confined to the precise point in real space where the thermometer was placed, but a somewhat larger area whose geography and form resembles the recording position (e.g. urban, rural, suburban, residential, etc). It is only when results from many different measurement locations are combined systematically that it becomes possible to assemble, literally and metaphorically, a broad if only provisional picture of weather.

The image DEFRA's maps present, consequently, is not of a "sometime, someplace," but a "no-time, no-where." That is to say, while the maps do present a clear, compelling, and easy-to-read image—one that conforms to EU directives—it is one, at root, that disregards anything more than a very narrow definition of what "noise" is, what

a sound survey ought to reveal, and what our experience of that place could possibly be. It reflects an almost exact reversal of the idea of sonic engagement, since the image presented by the map does not depend on sound at all, but rather, the precise measurement, documentation, and projection of the physical environment.

These problems and compromises can be seen clearly in how DEFRA's maps use color. Here, they borrow conceptually from other, more familiar forms of thematic cartography, like traffic maps. Red, commonly used to signal warning, danger, or the need for caution, is on DEFRA's maps used to identify areas of extreme loudness. Areas marked green or yellow, on the other hand, imply relative safety and quietude. But adding this extra layer of information has an important side effect. However apparently detached or objective they may appear, this familiar color scheme suggests sound has not been simply evaluated strategically, but indeed valued. The maps do not simply "show noise," but implicitly warn us about it.

Color coding also, perhaps unintentionally, helps expose other peculiarities. Human pathways, for instance, like those through Hyde Park, have no sound data attached to them at all and are colored gray as a result. (Figure 2-17A) The same holds true for ponds or waterways, which are colored a neutral blue. This suggests by implication that sound somehow stops at the edge of the pathway, going no further than the curb on the nearby road. The flaw in this assumption should be obvious to anyone who has found themselves in a noisy urban park: lived experience tells us that sound observes no such boundaries. Like weather, it flows through space, blurring the distinction between roads and sidewalks, ponds and highways. Alas, these maps provide nothing more than a

reductionist image of environmental sound, one based fundamentally on a "projection" determined by computer models.

Such obvious flaws, however, have not stifled creative adaptation. One fascinating artistic treatment of DEFRA's maps can be found in the work of English graphic designer and artist Simon Elvins.[68] In 2006, Elvins inverted DEFRA's data to create a map exposing not London's noisiest areas, but its most silent. He did it by transforming all of the color information on DEFRA's maps into grayscale, so that red became dark gray, and green or yellow lighter shades. This data was then inverted—dark to light, light to dark— which allowed the "silent" areas of London to emerge in the foreground. But this had an unusual consequence: foot paths, even those in parks, are rendered the same tone as busy streets. (Figure 2-16B) Rather than being subversive—by suggesting, somehow, a different way to engage with or value the city's sounds—the end result further confuses what were purely data-driven oversights in the first place. Elvin's map—as compelling and provocative as it appears—is nonetheless inextricably bound to the very same technical and conceptual flaws as DEFRA's.

To be fair, many of the objections and limitations I have raised here are acknowledged even by DEFRA. One prominent disclaimer located on their website explains how

the maps are only intended to be used for strategic assessment of noise levels in any given area. They should not be used to attempt to determine, represent or imply precisely the noise levels at individual locations (e.g. individual houses, windows). It should also be borne in mind that the noise levels shown are for an average day in

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[68] Simon Elvins, "Silent London," http://www.simonelvins.com/silent_london.html (accessed 13 January 2010). Elvins' map is also available in a compilation of London Maps. See: Simon Foxell, *Mapping London: Making Sense of the City,* London: Black Dog Publishing, 2007.

the year, and therefore do not show the specific noise from individual vehicles, trains, or aircraft or from discrete industrial activities.[69]

But in acknowledging these shortcomings, the map arguably becomes even less meaningful than it was before. Indeed, to say its use should be limited to "strategic assessment" is to add vagary on top of the already vague. If they cannot be used to "determine, represent or imply" the sound levels at a particular area, one might rightly wonder what a "strategic assessment" would allow us to assess.

Admittedly, DEFRA's statement is probably meant as a legal disclaimer—and with good reason. Scholars from fields like economics and sociology have for the last several decades worked to quantify the measurable impact of noise—for instance, by studying its adverse effect on housing prices and minority groups.[70] Any tool able to tangibly link noise to a specific location, especially one created by a recognized governmental body, could easily become useful in a legal struggle waged by property owners looking to recoup lost value, or by noise-afflicted populations seeking some relief. In effect, then, DEFRA's disclaimer extinguishes the usefulness of their maps—suggesting the EU directive is itself the only reason for their construction.

The need to map environmental sound, articulated at nearly every institutional level —international, national, and local—highlights some uncomfortable associations with

[69] Department for Environment, Food, and Rural Affairs, "Noise Mapping England: Frequently Asked Questions," http://services.defra.gov.uk (accessed 2 November 2010).

[70] Andrea Baranzini and José V. Ramirez, "Paying for Quietness: The Impact of Noise on Geneva Rents," *Urban Studies* 42, no. 4 (April 2005): 633-646; Jon P. Nelson, "Meta-Analysis of Airport Noise and Hedonic Property Values: Problems and Prospects," *Journal of Transport Economics and Policy* 38, no. 1 (January 2004): 1-27; G. Pennington, N. Topham, and R. Ward, "Aircraft Noise and Residential Property Values Adjacent to Manchester International Airport," *Journal of Transport Economics and Policy* 24, no. 1 (January 1990): 49-59; Julii S. Brainard et al., "Exposure to Environmental Urban Noise Pollution in Birmingham, UK," *Urban Studies* 41, no. 13 (December 2004): 2581-2600.

Foucault's notion of "biopower." The state, these maps suggest, is not only concerned with the health of our ears (and by extension, our physical and psychological wellbeing), but it has the right to measure, enforce, and change what they hear. Indeed, as will be discussed at length in Chapter 3, not only is it possible to monitor and control physical space—the flow of traffic, the gathering of crowds or mobs—but also the more ephemeral dimensions of everyday life: the *sound* of traffic; perhaps even the *sound* of crowds and mobs.[71] Alternatively, it becomes possible for the state to mandate what sounds must be tolerated, a process I will discuss later as "positive" enclosure. In any case, the image presented by territory maps is potentially an ominous one—where sound has been narrowly defined and space totally controlled.

The need to acquire an increasingly complete understanding of sound—or, more accurately, to estimate it "strategically"—also suggests close associations with neoliberal power structures, which themselves emerged during the late 1970s and early 80s. As governments became increasingly aware of the power of the market, entranced with the idea that choice, desire, and cultural values could be reduced neatly into data points, territory maps offer a convincing way to do the same: to condense even the most slippery and ephemeral dimensions of everyday life into an easy-to-understand form. But in doing so, in creating an image of the sound environment that, in reality, is little more than an extrapolation of computer models, territory maps arguably dis-place the very communities they are supposed to represent.

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[71] Michel Foucault, *Discipline and Punish: The Birth of the Prison,* translated by Alan Sheridan (New York: Vintage Books, 1977).

Type Five: Dynamic maps, becoming fields and grids

In contrast with territory maps, the fifth and final type, dynamic maps, can be characterized by their dependence on active and ongoing community participation. Unlike field and grid maps, which, though participatory, are ultimately constructed by trained specialists, dynamic maps return the process of constructing the map to ordinary people—or at least claim to. By definition, then, they are impossible to complete: dynamic maps are fueled by sonic crowd-sourcing; they are "open" forms meant to be continually expanded, refined, and improved upon with the addition of new information.

Dependent as they are on digital and interactive media environments, dynamic maps are clear beneficiaries of the internet age. Online maps permit, even encourage, the constant adjustment, re-scaling, tagging, and modification of represented space. Indeed, as internet maps first began to emerge during the late 1990s and early 2000s, they promised a remarkable array of advancements. Not only would they allow us to see Earth in new and compelling ways, and with incredible precision and detail, they would help create "immersive" experiences.[72] As John Pickles wrote,

> [a]s the hard work of imaging the earth in this way continues, a broad cultural economy of vision in depth may be being constructed. ... Full-immersion environments and VR simulations push these ontologies of transparency to their full extension and ... invest their subjects in depth. Gone are ontologies of non-penetrable surfaces and objects. Now all objects are bundles of information that can be imaged in as many ways as they can be imagined.[73]

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[72] See: Alan M. Maceachren and D. R. Fraser Taylor, eds. *Visualization in Modern Cartography,* New York: Elsevier Science, 1994. This collection of essays does an excellent job surveying the developments in cartographic visualization, but has become somewhat dated given the rapid pace of technological change over the past 15 years. It nevertheless contains some early glimpses at how the arrival of digital mapping changed how we think about and practice cartography -- and in that sense, is an important source.

[73] Pickles, *A History of Spaces,* 170.

With satellite imagery and 3D modeling, dynamic maps today allow other kinds of

information—including sound files—to be embedded beneath the virtual surface. Space,

then, becomes not just manipulable, but potentially audible as well.

One notable example of a dynamic sound map is "Sounds Around You," a website

operated by the Acoustic Research Centre at the University of Salford in Manchester.

(Figure 2-18) Although not explicitly stated, this project seems to adopt something of the

"ear cleaning" activism of the WSP. Their project, as they explain it, is designed to "raise

awareness of how our soundscape influences us and could have far reaching implications

for professions and social groups ranging from urban planners to house buyers."[74] They

continue:

> We're calling people across the world to use their mobile phones (or another audio
> recording device if their phone is not compatible) to record 10-15 second clips from
> different sound environments, or 'soundscapes' from a family car journey to a busy
> shopping centre, and to upload them to our virtual map, along with their opinions of
> them and why they chose to record it.[75]

Participants can either download a free application onto their smartphone, record the

sound directly into the application, and then answer questions as the file uploads to the

website; or they can use a digital recorder to collect sound, upload, and complete the

rating system later.[76] By relying on "everyday" technology, the hope is that anyone can

contribute; and by requiring participants to submit their opinions and thoughts about

[74] "Welcome to Sound Around You," *Sounds Around You,* http://www.soundaroundyou.com (accessed 17 January 2011).

[75] Ibid.

[76] "How to Get Involved," *Sounds Around You,* http://www.soundaroundyou.com (accessed 17 January 2011).

sound, in addition to providing a sound file, the hope is to encourage a more critical and thoughtful engagement with sound more broadly.

This project correlates well with characteristics of "Web 2.0," described for the first time by web pioneer Tim O'Reilly in 2005.[77] Developed after the tech bubble burst in 2001, Web 2.0 was thought to have initiated a complete re-imagining of the internet and its structural limitations. Where the pre-crash version favored top-down content generation, Web 2.0 relied on the idea that user generated content was the "key to market domination," a way to harness collective, emergent wisdom, and function democratically: the more contributions, the more likely people would be engaged and loyal (e.g. to a brand), the more likely the web would remain a level playing field. But this enthusiasm has yielded unforeseen complications. The sheer volume of information that has accumulated on the web has lead some critics to wonder not just who owns what— whether a user-submitted book review at Amazon.com is owned by Amazon or the user— but whether the web environment is really quite so level.[78] While the "democratic" aspirations of Web 2.0 are admirable in many ways, the future of personal information and privacy remain uncertain.

Related concerns emerge about dynamic sound maps. Particularly troubling is the way the rhetoric of "democratization" has been accompanied by a lax sense of self-consciousness, an almost regressive grasp of sound, technology, and the process of mapping itself. In an immediate sense, a map like "Sounds Around You" does seem to

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[77] Tim O'Reilly, "What is Web 2.0?" http://oreilly.com/pub/a/web2/archive/what-is-web-20.html?page=1 (accessed 30 January 2011).

[78] See for instance: Paul Hyman, "Gender Bias at Wikipedia?" *Communications of the ACM* 54, no. 10 (2011): 18.

create what Pickles described: an ontology of "depth." But the details and discourse

surrounding it suggest something else, too: an ontology of unevenness and confusion.

Very often, dynamic maps are meant to "flatten" distinctions—between sound and

representations of sound; between space and representations of space; between map

designer and map contributor. But in doing so, they consequently mask the limited frame

of the map itself, confusing the accumulation of data with factual reality. "Sounds Around

You" suggests, for instance, that the more information submitted by users, the more

accurate the map will be:

> [a] soundscape map gives an insight into how soundscapes are perceived by different people in a given location. The map will be constantly evolving as it automatically retrieves new soundscapes from the database.
>
> The addition of more soundscapes to the map brings about a more representative impression of the way in which people react to the sound around them.[79]

The idea that "more" equals "more representative" is flawed in both a technical and

statistical sense. Where earlier sound maps, like those of the LNS, were both critically

and consciously aware of their limitations, "Sounds Around You" seems by comparison

to embrace the idea presented earlier by Lewis Carroll in *Sylvie and Bruno:* the larger the

map, the more information it contains, the more representative it will be.[80] Indeed, as the

WSP showed, the creation of a "convincing image" of the soundscape depends on a

multifaceted analysis, one that takes into consideration both subjective and empirical

dimensions of the sonic environment. It is certainly possible to raise public awareness by

encouraging ordinary people to record sound and participate in a mapping project; but the

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[79] "World Soundscape Map," *Sounds Around You,* http://www.soundaroundyou.com (accessed 17 January 2011).

[80] See Chapter 1, pp. 45-46.

results cannot be universalized and do not stand outside this already narrow context. It is

also important to emphasize that a recording is not equivalent to perception, plain and

simple. The former is a material object, a sonic representation; the latter, is an extremely

complicated construct—one that bridges, among other things, individual memory,

physical variations in one's ability to hear, a sense of community, and shared (in this case,

aural) history. In any sound survey, there exist many different layers to pull back, many

different ways to experience sound and methods through which to study it. Certainly

what is audible (in the words of the BRS) "objectively" is not the same as what is

perceived; and certainly, what a recording captures is not equivalent to what a person

hears.

Another dynamic map, however, seems more aware of these concerns even to the

point of raising them explicitly. The website for the "Montréal Sound Map," argues that,

what I have called dynamic maps,

> are in many ways the most effective auditory archive of an environment, touching on
> aspects political, artistic, cultural, historical, and technological .... The Montréal
> Sound Map is an ongoing and continually evolving project with the goal of a constant
> addition of new recordings being placed into a browsable tagging system.[81]

Though compelling, this idea—of the map as an "archive" rather than "representation,"

as the accumulation of fact rather than discourse—raises its own set of concerns: about

sound as an artifact, about the potential for a map to function as a database. Something

resembling a "map-archive" would suggest a radical ontological departure, one where the

map gains a sense of formal "closure" (the boundaries and purpose of the map are

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[81] "About," *Montreal Sound Map*, http://cessa.music.concordia.ca/soundmap/en/ (accessed 17 January 2011).

determined) and content "openness" (the specific sounds the map will represent are unknown). The consequent elevation of the sound map—from a cultural and social construction, to an all-consuming representation—seems troubling, because it raises questions about the kinds and types of sounds allowed into the archive. The Montreal map further compounds these problems by requiring users to "tag" meta-data for each clip according to a few predefined categories: human, mechanical, natural, societal, music, noise. (Figure 2-19) Further categories follow: "noise," for instance, can be sub-tagged as human, mechanical, or natural. Of course, these categorizations risk backsliding into uncritical terrain: Is a sound "noise" because it is "unwanted," or "harmful?" Or is it (in a more neutral way) "chaotic" or "unorganized?" Could the "noise" be meaningful to a specific community, as the WSP suggests? Or is "noise" rather a metaphysical category, its relative "importance" or clarity irrelevant?

A similarly ambitious project, and one with similar problems, is operated by "radio aporee." (Figure 2-20) Begun in 2006, the goal of this map is to connect

> sound and space in order to create a cartography which focusses solely on sound, open to the public as a collaborative project. It contains recordings from numerous urban, rural and natural environments, showing its audible complexity, as well as the different perceptions, practices and artistic perspectives related to sound, space and sense of place.[82]

Apart from the uncomfortable fact that sound maps cannot ever "focus solely on sound"—simply by virtue of being already embedded within cartographic discourse—there is in this map a concerted effort to disqualify contributions in which sound has been manipulated, even "musicalized." Sound, for this map, is somewhat paradoxically

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[82] "about the project," *radio aporee, http://aporee.org/maps/info* (accessed 12 January 2011).

defined as the "different perceptions, practices and artistic perspectives" ordinarily

excluded from "music" in a more generic sense. "Do not send music, songs, your greatest

hits collection, recordings of concerts," they write. "[W]orkings, mixing, composing or

sound manipulations are also undesirable.[83]

Of course, the very notion of an "unmanipulated" sound is an oxymoron, since

recording a sound, even for the sake of archiving it, intrinsically entails manipulation.

While they may be used to foster close listening, recordings can never have "true

fidelity" to the original sound no matter how skillfully they are made—since the entire

notion of fidelity, as Jonathan Sterne has written, is a discursive construct rooted in

corporate marketing schemes of the late 19th and early 20th century.[84] Nonetheless, "radio

aporee's" project, as its operators understand it, concerns nothing more than "sounds and

sites;" and the only way to participate is to "get yourself a recorder, and go out and

listen."[85] Yet again, a somewhat confused ontology emerges, since sound recorders do not

listen to sound: they record it.

Dynamic sound maps, however, do not always concern strictly "environmental" or

"urban" sounds to the overt exclusion of music. One contrary example can be seen in the

"Musical World Map," whose creators explain

> users will be able to navigate on the map while listening to the music of the country or
> city associated with that particular location ... The main goal is to provide a teaching
> tool for students by providing listening examples from countries and cities while they

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[83] Ibid.

[84] Jonathan Sterne, *The Audible Past: The Cultural Origins of Sound Reproduction* (Durham, NC: Duke University Press, 2003), 215-225, 261-66.

[85] "about content," *radio aporee, http://aporee.org/maps/info* (accessed 12 January 2011).

are exploring the world …. [I]t would be interesting to explore the concept of audio boundaries of countries, as opposed to actual national borders.[86]

Of course, simply by titling their project the "Musical World Map," they make an implicit value judgment about what music is, how an "audio boundary" might be defined (stylistically, tonally, rhythmically) and what kind of "listening examples" and "musical practices" are representative of a particular place. Simultaneously, they exclude a whole host of alternate possibilities, interpretations, and divergent practices. Indeed, music, in this case, is elevated to an almost universal status—an ideal without borders. Here again the idea of the base map as a representation of pure space reemerges. What makes a map "political," it is supposed, is the drawing of boundaries and borders. Without them, the map would, if not disappear, then recede quietly into the background. But in fact, as cartographic discourse has suggested, the exact opposite is true. It is when a map claims to show nothing but "pure space" that we must be especially cautious; it is when a map claims to depict only "what it shows" that the material processes operating beneath the surface become especially relevant.

Indeed, the "Musical World Map," like other dynamic maps, relies on Google-based mapping software. And this, in and of itself, might reasonably cause concern. Though a tremendously powerful and versatile tool, and certainly a cheap one, Google Maps belongs to Google Inc.—an international corporation worth well over $100 billion. Google, of course, has its own reasons for making software that is easy to use and easy to

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[86] "Long Info," *Musical World Map (beta)*, http://www.musicalworldmap.org/long-info (accessed 17 January 2011).

access: from data mining to geo-marketing.[87] More worrisome is that the software, especially GPS data and satellite imagery, depends more or less directly on military capabilities and the accumulation of corporate wealth. Certainly there is ample reason to be cautious of the emancipatory rhetoric that surrounds Google-based maps; so, while dynamic maps offer a potentially liberating way for us to rethink human relations and cultural boundaries—as the "Musical World Map" does, by drawing borders without regard for political territory—their existence nonetheless depends on the same forms of power they might seem otherwise to critique.

This raises perhaps the most important question of all: For whom are maps like these representative? If the "Musical World Map" is any indication, it is worth noting how the majority of contributions come from western Europe and the United States, though South America and Africa have a few. Most contributions furthermore seem to come from large, highly populated urban areas—suggesting the "silences" on this map are quite literal: rural, poor, isolated. These silences furthermore highlight even more serious concerns: those of global wealth and power inequality. Participation, that is to say, necessarily requires baseline technical competencies, not to mention easy and affordable access to the internet. So, in spite of the exuberant spirit of "democracy" and "participation" that surrounds dynamic maps, they also reinforce the unfortunate truth that being heard often requires material wealth. Visible, then, is a kind of sonic

[87] Siva Vaidhyanathan, *The Googlization of Everything (And Why We Should Worry)* (Berkeley: University of California Press, 2011), 17.

subalternity:[88] entire communities of people whose sounds are not, and likely will not, be

heard—either because of adverse political and economic circumstances, or because the

idea of an "interactive sound mapping project" is itself so far removed from the concerns

of everyday life that there is little reason to participate.

That dynamic maps depend on public participation seems a positive development.

But de-professionalization risks legitimizing a confused—and deeply *valued*, not just

evaluated—ontology, one plagued by the uncritical adoption of concepts like "sound,"

"music," "noise," "machine," "human," and "nature." Far from challenging existing

boundaries and establishing new ones, dynamic maps tread a difficult path that risks

confusing all of them. Yet, because their defining characteristic is participation, the maps

themselves become important primarily as sociological and historiographic artifacts.

Much like other Web 2.0 resources, including Wikipedia, dynamic maps are important

primarily because they offer a limited glimpse into how untrained people hear the world

and find meaning in it—problems, misconceptions, mappings, re-mappings, and confused

ontologies included.

Conclusion
In this chapter, I outlined a broad typology that can be used to study environmental

sound maps. In all, I proposed five general types, each distinguished by significant visual

and methodological characteristics. Grid maps, based often on empirical measurements,

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[88] My obvious reference here is the postcolonial concept of "subalternity" proposed by Gayatri Spivak. While on the surface the connection between unheard sounds and the plight of marginalized peoples seems strained, I do believe the two are connected. Further analysis, however, will have to be left for a future project. See: Gayatri Chakravorty Spivak, "Can the Subaltern Speak?" in *Marxism and the Interpretation of Culture*, ed. C. Nelson and L. Grossberg (Champaign, IL: University of Illinois Press, 1990).

weave a regular fabric of represented sound across a conventional base map. Field maps, though driven by professional observation, help show how sound establishes a community's sense of identity. Walk maps, or "soundwalk" maps, turn this identity into an experience, a creative act, by suggesting or prescribing movement between or among places with specifically sonic significance. Territory maps, like grid maps, return to more objective forms of analysis; except territory maps, unlike grids, are often backed by specifically political and regulatory forms of authority: they project an image of "estimated" sound for the purpose of controlling noise (and listening bodies). Dynamic maps return to subjective experience and claim to become radically participatory by foregrounding the active, though not always self-critical, contributions of ordinary people.

In the following chapter, I wish to model the kind of analysis this typology makes possible. I will therefore turn my attention to a specific "territory" mapping practice— Part 150 "Noise Exposure Maps," which are created as part of a voluntary aviation noise exposure program managed by the Federal Aviation Administration in the United States. As I will show, these maps raise a host of questions and concerns that come into focus only once they are situated in a larger context of political power and property rights. Indeed, as I will argue, NEMs prefigure the closing of the "acoustic commons," performing through force of law the accumulation of the aural environment by powerful economic and state interests.

Chapter 3: Analyzing a "Territory" Sound Map

> Through a long process of enclosures, the earth's surface has been almost completely divided up between public and private property so that common land regimes ... have been destroyed.
> —Michael Hardt and Antonio Negri, *Commonwealth*

Introduction

Sound maps mediate power. As I explained in Chapter 2, recent work in the history of cartography has shown that maps are not merely self-evident presentations, but rather persuasive re-presentations with the potential to influence how we perceive the world surrounding us. Sound maps are certainly no exception, and the typology I proposed is designed to foreground some of their machinations. Conceivably, case studies of each type would involve following the (sometimes literal) contours of power, tracing how choices were made and why. And in defining each type in the previous chapter, I provided something of a model for how these case studies would proceed. A study of grid maps, for instance, would focus not only on the final image, the grid itself, but on how the size and scope of the underlying survey was determined, and how that study in turn shaped which aspects of sound were selected for representation. Similarly, studying a "dynamic" map would involve examining how contributors are enrolled, where they come from, and how sounds are qualified and classified in the (often concealed) meta-data. Certainly, in this instance, a case study would also involve challenging the lofty rhetoric of "liberation" that too often surrounds dynamic maps.

In this comparatively brief chapter, however, I wish to focus my analytical gaze on one sound map type: a "territory" mapping practice, known as aviation "Noise Exposure Maps" (NEMs). The reason to focus extra attention on this type, and indeed, this

particular kind of map, is quite simple: a defining feature of the territory map is its backing by political authority. Territory maps always have a bureaucratic, institutional, or regulatory purpose, even if that purpose is not clearly defined. For instance, DEFRA maps, mandated by 2002/49/EC, are used to estimate noise exposure in cities with populations greater than 250,000 people. While it is implied that these maps have (or at least, should have) some influence on our efforts to study and regulate noise, as a form of air pollution, the maps themselves are more generally used to focus public discourse. The maps I will discuss in this chapter, however, go even one step further. As interesting and compelling as NEMs may seem, they in fact wield an overt form of acoustic power. As I will suggest below, in functioning as an arm of the neoliberal economy and embedded within regulatory policy, these maps change not only how we relate to sound, but reconfigure the nature of that relationship altogether. Rather than establishing a right to quiet, they demonstrate affirmatively which sounds we must be willing to endure, and at what price—a process I call "positive" enclosure.

On Noise

Noise is a topic which regularly inspires vocal and, at times, militaristic activism. And with good reason. Beyond simply disturbing the peace, recent environmental and medical research suggests that noise—defined usually as "unwanted sound"—has any number of detrimental health effects, not the least of which is the damage to our hearing.[1]

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[1] Some research suggests, however, that a sound's status as "unwanted" is an extremely significant factor when evaluating negative health impacts. One study found that "awareness and annoyance reactions to airplane noise were much more important in determining health problems than the level of exposure to airplane noise." (342) See: David B. Graeven, "The Effects of Airplane Noise on Health: An Examination of Three Hypotheses," *Journal of Health and Social Behavior* 15, no. 4 (December 1974): 336-343.

It has been linked to a litany of health problems, from sleep deprivation to psychological damage.[2] But as a threat to general health and welfare, noise is also a frustrating object, because, like the long-term health effects of cigarette smoke, it is, at least in theory, preventable.[3]

Efforts to combat noise are themselves not recent, however. As Karin Bijsterveld writes in *Mechanical Sound,* a wide range of interest groups began to warn of the looming threat of environmental noise as early as the turn of the 20th century.[4] Many used the same list of enemies: industrial equipment and household machines—including gramophones, radios, automobiles, and vacuums—being used for the first time by a newly-emerging middle class.[5] Of equal or greater concern, though, were "passive" noise offenders, like old houses and apartment buildings, which lacked sufficient insulation to protect their occupants from noisy neighbors.[6] Often, activists used traditional political tactics to combat unwanted sound—from lobbying for the manufacture of quiet vacuum

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[2] Lisa Goines and Louis Hagler, "Noise Pollution: A Modern Plague," *Southern Medical Journal* 100, no. 3 (March 2007): 287-294. In addition to sleep loss, Goines and Hagler identify cardiovascular and mental health disturbances as particularly ominous health effects of prolonged exposure to noise.

[3] Ibid., 293. "As a society, our history is filled with failures to recognize the agents that cause disease; once the causes have been recognized, we have responded reluctantly, slowly, and often inadequately. The case with tobacco is an instructive one. It took many years of lobbying by dedicated individuals before legislators and the general public recognized the links be-tween the hazards of tobacco smoke and disease; as a result, laws were finally enacted and behaviors changed accordingly... Noise makers and the businesses that support them are as reluctant as smokers to give up their bad habits. Legislators at all levels should protect us from noise pollution the same way they protected us from tobacco smoke and other forms of pollution."

[4] Karin Bijsterveld, *Mechanical Sound: Technology, Culture, and Public Problems of Noise in the Twentieth Century* (Cambridge, MA: MIT Press, 2008), 6.

[5] Ibid., 165-66.

[6] Ibid., 163-64.

cleaners, to mounting educational antinoise campaigns, complete with propaganda

posters.[7] As Bijsterveld explains, though, some of these efforts were condemned by left-

leaning political parties, who believed working- and middle-class people were

disproportionately effected by them.[8] The leisure classes, they argued, did not have to

worry about unwanted sound from cars or radios, since they had the dual luxuries of time

during the day to enjoy their machinery, and physical distance from their neighbors,

which would mitigates sonic seepage. Additionally, traditional forms of acoustic

entertainment often favored by privileged classes—including live musical performance—

were often exempted by noise legislation, despite being potentially as bothersome.

As complaints about noise became themselves too loud to ignore, a number of

techniques were devised to help manage noise control. On the scientific front, the

development of the logarithmic decibel scale meant loudness could be measured

quantitatively and with some semblance of empirical consistency;[9] on the enforcement

front, towns and cities began to implement laws restricting noisy behavior;[10] on the

technological front, inventors began to manufacture handheld decibel meters, which,

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[7] Ibid., 174; 119-120; 122-123.

[8] Ibid., 165-68. Some socialists also stressed that "it was in the interest of working-class children to get enough sleep and that working-class adults should have the opportunity to unfold their talents during the evening, which meant they should not be annoyed by radio noise." (167-68) But as Bijsterveld points out, these arguments were the exception, and that most on the left found it unreasonable to place limits on the gramophone and radio while allowing more traditional musical instrument to be played without restraint.

[9] Ibid., 105.

[10] Ibid., 179-81. Bijsterveld points out, however, the belief that "the masses had a right to use their gramophones and radios and that sound perception was highly subjective." This made unlikely the regulation of private behavior based based on quantitative measurement alone.

despite their initial unreliability, were widely adopted by police to catch noise violators in the act.[11]

But if the relative success of these efforts can be measured by the volume of noise complaints that persist today, they must surely be said to have failed. Not much, it would seem, has changed over the past hundred years to either ease the continuing production of "unwanted" sound or to reduce in a meaningful way its negative effects on daily life and human health.[12] The latest and perhaps most aggressive volley of antinoise legislation was launched recently by the European Union.[13] Partly inspired by World Health Organization research,[14] directive 2002/49/EC requires cities with populations greater than 250,000 residents to create "strategic noise maps." Though limited in scope, the underlying hope is that maps like these can be used to help identify locations threatened by consistent and excessive noise exposure, isolate and identify the most egregious noise producers, and facilitate an ongoing public discussion about how to prevent future disruptions.[15]

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[11] Ibid., 174-78. The development of the handheld decibel meter itself can, indeed, be linked directly to attempts to regulate the production urban noise.

[12] Goines and Hagler, "Noise Pollution," 288. "That noise pollution continues to grow in scope, variety, and magnitude is unquestioned; it is only the extent of the growth that remains unknown."

[13] Commission Directive No. 2002/49, O.J. L 182/12, The European Parliament and the Council of the European Union, Directive 2002/49/EC, relating to the assessment and management of environmental noise, L. 189/12.

[14] World Health Organization, *Guidelines for Community Noise,* eds. Birgitta Berglund, Thomas Lindvall, Dietrich H Schwela, www.who.intdocstore/peh/noise/guidelines2.html (accessed 16 January 2010).

[15] Department for Environment, Food, and Rural Affairs, "Noise Mapping England," http://services.defra.gov.uk/wps/portal/noise (accessed 18 January 2013).

Maps, then, have become only the latest weapon in the ongoing "war on noise."

However, I am hesitant to embrace the word "noise" too eagerly and without

qualification. As highlighted above, while noise is generally accepted to be a legitimate

threat to public health, its conceptual boundaries are permeable, fluid. Where, in one

context, a particular sound might be "unwanted," in another, it could offer helpful and

meaningful information—providing advanced warning of looming danger (tornado

sirens) or of life-threatening situations (ambulance sirens). While it may, at times, seem

random and bothersome, noise can also express order in surprising ways.[16] As Henri

Lefebvre explained in *Rhythmanalysis*, from the apparent chaos of automobile traffic, to

the seemingly disorganized mass of people on the street, sound can express both

circadian rhythms and the rhythms of economic activity with surprising clarity—if we

care to listen.[17] Still, despite my general preference for a more neutral terminology—that

of "sound" and "sound map," rather than "noise" and "noise map"—I will throughout this

chapter use the term adopted by each primary source.

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[16] Henri Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life* (New York: Continuum International, 2004), 27. "[T]he attentive ear begins to separate out, to distinguish the sources, to bring them back together by perceiving interactions. If we cease to listen to sounds and noises and instead listen to our bodies (the importance of which cannot be stressed too greatly), we normally grasp (hear, understand) neither the rhythms nor their associations, which nonetheless constitute us."

[17] Ibid., 32. Although Lefebvre admits he provides more questions than answers, he suggests "there is somewhere in this present an order, which comes from elsewhere. Which reveals itself. Where? In the monuments, the palaces, from the *Archives* to the Bank of France, meteorites fallen from another planet into the popular centre, for so long abandoned, the *Cour des Miracles,* a place of rogues. Therefore, besides the present, a sort of presence-absence, badly localised and strong: the State, which is not seen from the window, but which looms over this present, the omnipresent State." (32) This thread of thought will be more directly developed in Chapter 5.

Dropping Lines

By the late 1980s, Edmund Lindsey had reached a breaking point. The noise from the Memphis International Airport had become so unbearable that he decided to file suit, claiming "inverse condemnation" of his home located at the southwest end of runway 36L. His complaint was later grouped into a larger class action; but after a preliminary settlement was announced, Lindsey decided to file an appeal. He argued the proposed terms were inadequate, and that the suit should have continued until more favorable terms were reached.[18] Lindsey's case ultimately found its way to the 6th Circuit Court of Appeals in Cincinnati.[19] Court documents suggest, however, that his complaint concerned much more than a particular settlement or dollar amount. Many of his neighbors had been moving away since the initial claim was filed in the early 1990s. But because Lindsey found himself unable to sell his home, he believed he was being pressured and harassed by the airport authority to accept a new and inevitably noisy future—and that they were using unconventional means to do it.

This became clear during a particularly bizarre moment of a fairness hearing in 1998. Lindsey was asked: "Do you honestly believe that someone ... flew over ... in an airplane and dropped two raccoons on your house?"

> **Lindsey**: Yes, sir. There's no other way it could have happened. Airplanes went over our house at the time this happened. So there's no other way it could have happened.
> **The Court**: Memphis has got a lot [of] raccoons in it.
> **Lindsey**: But to get on top of my house you've got to have an airplane to get up there or helicopter one.

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[18] Alvarado v. Memphis-Shelby County Airport Authority, 2000 U.S. App LEXIS 21259 (August 15, 2000, Filed), "Overview."

[19] Ibid.

This exchange seems odd, but Lindsey was right in at least one respect. While the airport authority almost certainly did not conspire to intimidate him, something had been dropped on his house. Only, instead of raccoons, it was isobel lines. A map of the Memphis airport, produced in 1985, locates Lindsey's home squarely within the 75dB contour. (Figure 3-1.) In no small measure, it was this line that was responsible for the dismissal of his appeal. Its very existence meant Lindsey's house had become part of a sonic territory; and as a result, he had no right or legal grounds to expect special legal consideration beyond the limits of the class action.

The Noise Exposure Map, or NEM, is a powerful and under-scrutinized regulatory tool. Its contours function to establish boundaries in both a literal and figurative sense: not only do they define where sound is and what intensities should be expected, they establish sound as within the government's power to monitor and regulate. Though seldom discussed outside of a narrow regulatory and legal context, they raise important questions about the nature of property, about how "community" is defined, and more significantly, about how sound functions as an instrument of the state. In addition to exploring how NEMs are constructed, I will draw on the recent work of Michael Hardt and Antonio Negri to argue that, more than merely representing the acoustic environment, they work to change how and on what terms we relate to it.

Technics and Technicalities

As a component of the "Airport Noise Compatibility Planning Program," Part 150 was first issued on an interim basis under the the Aviation Safety and Noise Abatement Act of 1979. Although final rules were not issued until 1985, its purpose from the very

beginning was to establish uniform guidelines for conducting Noise Compatibility

Programs (NCPs). Part 150 has a few key functions. The first is to establish noise

standards and units. It stipulates, for example, that all sound-level readings should be

calibrated to the dBA-weighting—which is itself a peculiarity, since A-weighting tends to

discriminate against low-frequency sounds, like airport noise. The second function is to

define land-use compatibility by establishing what activities are suited to different levels

and durations of sound exposure. Outdoor music shells, for instance, are not considered

compatible with 65-70dB or higher; neither are mobile home parks or schools. Third, it

formalizes a review and approval process for NCPs and routinizes access to

compensatory funds for those people adversely impacted by noise.[20]

Noise Exposure Maps (NEMs) are specifically authorized by Title 49 of the US

Code and directly shaped by these standards. Creating a NEM means first establishing the

DNL for a given area—that is, the average loudness, day or night, for any particular

location near the airport. In theory, this information is then superimposed onto detailed

geophysical maps, scaled not less than 1":2000', and connected using isolines; "in

theory," because what might otherwise require localized and labor-intensive listening has

been streamlined significantly following the introduction of automated analytical tools.

Part 150 allows for the use of computer software called the Integrated Noise Model

(INM), which can generate both noise readings and sound contours automatically. All that

is needed is statistical, geophysical, and aviation data, including information about the

"specific operation mode, thrust setting, and source-receiver geometry, acoustic

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[20] Federal Aviation Administration, "The FAR Part 150 Airport Noise Compatibility Planning Program: An Overview," http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/planning_toolkit/media/II.B.pdf (accessed 20 June 2012).

directivity and other environmental factors," as well as the topography of the airport and existing airspace restrictions.[21] The Federal Aviation Administration (FAA) consequently describes the INM as the "preferred model" to create NEMs—and it is in fact among the most widely-used noise software in the world today. It can generate sound readings for almost any occasion, place, or moment in time, and contains officially-sanctioned sound profiles for well over 100 different aircraft types. It is also incredibly versatile. In addition to contour maps, the INM can also generate supplementary maps to show other kinds of acoustical information, like the statistical likelihood that sound above 65dB will be heard at any particular moment. (Figure 3-2.)

While the FAA approves the final outcome, they neither create NEMs nor conduct NCPs. Local airport operators do all of this, though practically speaking, work is usually contracted to outside consulting firms.[22] A further peculiarity about NEMs is that they are inadmissible as evidence in a lawsuit. Legally, their only function is to disqualify complaints.[23] After announcing that a NCP will be conducted, preliminary NEMs must be presented during a public approval process. Afterward, however, nothing except a drastic change in airport operations can cause either the maps or the conclusions and recommendations of the NCP to be contested or reevaluated. NEMs are in that sense performative: rather than contributing to an analytical or evaluative process, they are

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[21] Federal Aviation Administration, "Integrated Noise Model (INM)," http://www.faa.gov/about/office_org/headquarters_offices/apl/research/models/inm_model/

[22] One such consulting firm, which claims to have been "delivering solutions to our airport clients for more than 40 years," is Environmental Science Associated (ESA), http://esassoc.com/ (accessed 18 July 2012).

[23] *Transportation. U.S. Code.* Vol. 49, ch. 475, subchapter 1, "Noise Abatement."

what stamps the process complete.[24] Once certified by the FAA, there is no mechanism

for property owners—living, as Lindsey was, within the 75dB isoline—to challenge

either the location of a contour or, more importantly, the underlying activities responsible

for generating it.

Context

The concept of "mapping" sound is certainly not unique to Title 49 or Part 150. It

can be traced to the work of musicians, anthropologists, and acoustic ecologists during

the 20th century who hoped to understand how sound shapes and is shaped by a

community's physical form and everyday activities. One of the earliest examples of such

sound mapping can be found in the work of Michael Southworth, whose research at MIT

during the early 1960s led him to study the aural composition of Boston. In his study, a

group of volunteers was subject to sensory deprivation—eyes or ears—and taken on a

wheelchair tour of the city. All were subsequently asked to explain the relative

importance of sound in defining each neighborhood they visited. Among their

observations was that some

> spaces seemed more meaningful and could be perceived more clearly when subjects
> could hear echoes of their own sounds. Spaces with ambiguous form confused
> subjects and they judged them differently. Opaque foreground sounds caused similar
> effects and camouflaged important information.[25]

These "textural" observations were later transferred onto a map—what I defined in

Chapter 2 as a field map—which coded different areas of the city based on their

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[24] Furthermore, as Section 47506 explains, "no person who acquires property or an interest
therein ... shall be entitled to recover damages with respect to the noise attributable to such
airport if such person had actual or constructive knowledge of the existence of such noise
exposure map..."

[25] Michael Southworth, "The Sonic Environment of Cities," *Environment and Behavior* 1, no. 1
(1969), 55.

perceptual identity. (Figure 3-3) Though an impermanent presence, often passing

unnoticed by people living within and moving through it, sound is shown to be a

structural force, one that shapes and influences everyday life in ways we do not often

appreciate.

This point was further elaborated during the 1970s by the World Soundscape

Project (WSP), a consortium of musicians and scholars at Simon Fraser University in

Canada. Their analyses, conducted throughout the 1970s, showed how ordinary sounds,

like the pitch of telephone dial tones, could be used to identify sonic relationships,

sometimes literally consonant or dissonant, among neighborhoods within large urban

areas. (Figure 2-7) They also used maps to show how memory and age can influence the

perception of a community's acoustic boundaries, (Figure 2-9) and how environmental

conditions like time, season, and weather can cause drastic fluctuations in ambient sound

levels. (Figure 2-12) Maps like these were among the first of their kind to render sound

cartographically, and the often visually compelling results functioned in subsequent WSP

publications to raise our collective aural consciousness.

But no survey of sound maps would be complete without considering also how they

have evolved in recent years. As digital maps began to emerge during the 1990s and early

2000s, they promised an exciting array of advancements: not only would they allow us to

see Earth in new ways and with incredible precision and detail, but they would become

"immersive."[26] As cartographic historian John Pickles wrote rather optimistically, "gone are ontologies of non-penetrable surfaces and objects. Now all objects are bundles of information that can be imaged in as many ways as they can be imagined."[27]

Many digital maps today allow other kinds of information—including sound files—to be embedded beneath the virtual surface. Space, then, becomes not just manipulable, but audible as well. One notable example is "Sounds Around You," a website operated by the Acoustic Research Centre at the University of Salford in Manchester. (Figure 2-18.) Although not explicitly stated, this project seems to adopt something of the earlier "ear cleaning" activism of the WSP. As they explain, their project asks

> ... people across the world to use their mobile phones ... to record 10-15 second clips from different sound environments, or 'soundscapes' from a family car journey to a busy shopping centre, and to upload them to our virtual map, along with their opinions of them and why they chose to record it.[28]

The presence of a digitally-embedded clip is indicated with a small flag pinpointing the GPS location in real space where the sound was recorded. When clicked, an embedded sound file begins to play; and to enhance the experience, a small box in the lower left hand corner defaults to street view.[29] The result, as Pickles suggests, is not just

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[26] See: Alan M. Maceachren and D. R. Fraser Taylor, eds. *Visualization in Modern Cartography* (New York: Elsevier Science, 1994). This collection of essays does an excellent job surveying the developments in cartographic visualization but has become somewhat dated given the rapid pace of technological change over the past 15 years. It nevertheless contains some early glimpses at how the arrival of digital mapping changed how we think about and practice cartography—and in that sense, is an important source.

[27] John Pickles, *A History of Spaces: Cartographic reason, mapping and the geo-coded world* (London and New York: Routledge, 2004), 170.

[28] "Welcome to Sound Around You," *Sounds Around You,* http://www.soundaroundyou.com (accessed 17 January 2011).

[29] "World Soundscape Map," *Sounds Around You,* http://www.soundaroundyou.com (accessed 17 January 2011).

interactive, but immersive. The ears, eyes, and hands all have something to do: listening,

viewing, and clicking. Even though what is seen does not exactly line up with what is

heard—for instance, the image captured by Google's street view car is almost certainly of

a different moment than the sound clip—the hope is to encourage a more personal,

critical, and thoughtful engagement with the acoustic environment.

In concept, these maps would seem to share much in common with NEMs. And

indeed, Barry Truax, a founding member of the World Soundscape Project, served on a

noise task force in Vancouver, which offered concrete recommendations for how to

reduce the impact of aviation sound.[30] It t is important to emphasize, however, that NEMs

are not the result of engaging with or listening to sound at all, nor can they be

characterized as anything other than indifferent to what people actually experience.[31]

Especially when INM software is used—which, today, is the vast majority of the time—

the acoustic environment, as they show it, is one that has been mapped *into* being. NEMs

consequently exist in a literal "no-man's land:" at the peculiar intersection of "estimated"

measurements, cybernetic feedback loops, and geophysical representation.

Rationalizing Sound

The fact NEMs hold the performative power to simultaneously create and define

sound should not come as a terrible surprise. As cartographic historians including J.B.

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[30] City of Vancouver, "City Noise: Report of the Urban Noise Task Force," http://vancouver.ca/ ctyclerk/cclerk/970513/citynoisereport/, April 1997 (accessed 18 July 2012).

[31] Some acoustical specialists have begun to question the accuracy and relevance of NEMs. See: Ian Jopson, "Aircraft Noise Model Validation: How Accurate Do We Need to Be?" http:// www.caa.co.uk/docs/68/dap_ercd_1102_modelaccuracy.pdf (accessed 10 July 2012).

Harley and Pickles have argued, maps are a form of "power-knowledge."[32] They should never be seen as disinterested or purely "objective" documents, even when presented that way. Maps are rather discursive: more than merely representing space, they participate in shaping how we understand and interact with it. As Harley explains, maps exhibit "an external power often centralized and exercised bureaucratically, imposed from above, and manifest in particular acts or phases of deliberate policy." Their power is commonly used to maintain control over boundaries, commerce, internal administration, population, and military strength.[33]

There is no reason to believe that NEMs are any different, and an important concern is the kind of "external power" they exercise. The answer becomes clear when NEMs are situated proximate to a much broader discourse: real estate. Beyond compatible land uses, which are established by Part 150, the specifically monetary impact of unwanted aviation sound is broadly contested, as demonstrated by conflicting conclusions on the subject. In a study of Reno, Nevada, for instance, Molly Espey and Hilary Lopez identify a strong negative impact on real estate, such that the "average home in areas where noise levels are 65 decibels or higher" sells for "about $2,400 less than equivalent homes in quieter areas." J. Tomkins, on the other hand, notes the opposite, explaining that "circumstances may exist where positive attributes, such as improved access and employment

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[32] J. B. Harley," Deconstructing the Map, *Cartographica* 26, no. 2 (Summer 1989): 1-19.

[33] Ibid., 12.

opportunities, may be more highly valued by local residents than the negative ... effects of airport proximity."[34]

In either case, at issue is not whether aviation sound effects the price of property—that much, it is supposed, goes without saying—but rather, by how much and in what direction. The larger discourse of power in which NEMs participate, the context they help literally to define, concerns hedonics: a form of property analysis aimed at determining how normative assessments of "goodness" and "badness" influence value. As critical theorists Michael Hardt and Antonio Negri have explained, and as Lindsey's legal case at least partly exemplifies, this kind of assessment has become increasingly common as the cultural and political climate affirms the belief that:

> the value of an apartment or a building or land in a city is not represented exclusively by the intrinsic characteristics of the property, such as the quality and size of its construction, but is also and even primarily determined by externalities—both negative externalities, such as air pollution ... and positive externalities, such as proximity to playgrounds.[35]

This is a belief very much woven-through with neoliberal economic philosophy, which David Harvey has written presumes "the existence of property rights over processes, things, and social relations, that a price can be put on them, and that they can be traded subject to legal contract."[36] What matters is not what we hear or experience *as such*, but whether or not the proper financial impact has been assessed. If it has not, Hardt and Negri explain, "[w]hen there are 'market distortions,' when externalities come into play

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[34] Molly Espey and Hillary Lopez, "The Impact of Airport Noise and Proximity on Residential Property Values," *Growth and Change* 31 (Summer 2000), 408; J. Tomkins et al., "Noise versus Access: The Impact of an Airport in an Urban Property Market," *Urban Studies* 35, no. 2 (1998), 243.

[35] Michael Hardt and Antonio Negri, *Commonwealth* (Cambridge, MA: Belknap Press of Harvard University Press, 2009), 154-55.

[36] David Harvey, *A Brief History of Neoliberalism* (New York: Oxford University Press, 2005), 165.

and social costs do not equal private costs, market rationality is lost and 'market failure' results ... neoliberal economists thus spend their time ... seeking ways to monetize pollution or traffic ... in order to ... restore logic to market exchanges."[37]

Indeed, this perhaps clarifies why NEMs have been so eagerly adopted by the political and sonic status quo. Because they are so commonly thought to represent "pure fact" rather than discourse, maps emerge as an almost ideal mechanism for rationalizing sound. Indeed, beyond their strictly technical function—the establishment or, more accurately, generation of noise contours and compatible uses—the broader purpose of NEMs is to prevent noise-induced market failure by reterritorializing space *sonically*.[38] They assert the existence of a specifically aural form of property, whose presence and influence can not only be anticipated objectively, but monetized and paid-for in advance. This also explains why the surrounding legal structure prevents new claims against the airport once a NEM has been constructed: the hedonic effect, as it were, has already been priced in.

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[37] Hardt and Negri, *Commonwealth*, 155.

[38] The concept of reterritorialization, as it is used by Deleuze and Guattari, refers to the emergence of new forms of being and new forms of power. Often used dialectically with the concept of "deterritorialization," reterritorialization is neither inherently "good" not "bad." As Deleuze and Guattari explain, minority groups must assert a sense of identity in order to achieve a coherent political voice. In this context, the context of the territorial map, "reterritorialization" refers to a process of consolidating power, extracting authority from ordinary people. And in that sense, reterritorialization is worthy of concern. See also: Chapter 4, page 181, note 90; Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia,* trans. Brian Massumi (Minneapolis and London: University of Minnesota Press, 1987), 291.

Closing the Commons

And yet, by operating on the assumption that sound is an externality to begin with, NEMs allow us also to glimpse their opposite: "a specter of the common."[39] This is because there is a secondary layer of power, a kind Harley explains is "internal" to the map and that "intersects and is embedded in knowledge." Studying it requires us to shift our gaze from "the place of cartography in a juridical system of power" to the "political effects of what cartographers do when they make maps."[40] For NEMs, this means analyzing how the map functions as a technocratic instrument used to reconfigure existing relationships—not only those linking sound to space and property in a legal or economic sense, but those guiding the emergence of bio-political subjectivity more generally.

What NEMs do, in that sense, is continue the process of bracketing, or removing, sound from collective, community control. Rather than being something we create or create with, NEMs re-situate sound as something used to create *us*. This may seem like an odd thing to suggest since the acoustic environment, even under the worst circumstances, would seem to be a common: a space we rely upon and are responsible for, one that sustains and invigorates our lives and that requires our care and respect in return. An "acoustic common" would furthermore seem inherently difficult to partition, since sound is nothing more than vibrations passing through the air. As anthropologist Tim Ingold has written, "sound flows, as wind blows, along irregular, winding paths, and the places it

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[39] Hardt and Negri, *Commonwealth*, 55.

[40] Harley, "Deconstructing the Map," 13.

describes are like eddies, formed by a circular movement around rather than a fixed location within."[41]

And yet, like other environmental and resource commons—water and air especially, which have increasingly been divided into pieces for the benefit of multinational water and energy companies—sound would seem to be the next common to be placed beyond reach. And it can come as little surprise. In *Commonwealth*, Hardt and Negri explain that, "through a long process of enclosures, the earth's surface has been almost completely divided up between public and private property so that common land regimes ... have been destroyed."[42] Enclosure is no less worrisome when the common is not otherwise tangible, since intellectual or sensory commons serve increasingly as an important site of experimentation and innovation. These commons allow, and even encourage, a kind of creative play that might not otherwise occur if they were segmented into parts that were owned and controlled by individuals or groups empowered to pursue their own self-interest at the expense of others. The example Hardt and Negri use is language, which, they say, "is for the most part common."[43]

> [I]f language were made either private or public—that is, if large portions of our words, phrases, or parts of speech were subject to private ownership or public authority—then language would lose its powers of expression, creativity, and communication.[44]

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[41] Tim Ingold, "Against Soundscape," in *Autumn Leaves: Sound and the Environment in Artistic Practice,* ed. Angus Carlyle (Paris: Double Entendre, 2007), 12.

[42] Hardt and Negri, *Commonwealth,* ix.

[43] Ibid.

[44] Ibid.

NEMs change how we relate to what we hear. They first erect an institutional framework —an act of reterritorialization, one that requires estimating sound levels and reassessing sound as a form of property. Then, they perform an act of "positive" enclosure. While the maps do not prohibit us from making new sounds of our own, they do specify the kind of sounds we must endure, willingly or not. NEMs take what was a shared environment, one we all contributed to and took from, and grant priority access to powerful economic and state interests. This means, in effect, that anything can be heard: in an abstract sense, our behavior—our ability to play music outside, have picnics, or make "noise"—is not changed. The defining feature of positive enclosure is that certain sounds, in this case, those of airplanes landing and taking-off, must be endured if they can be heard. All other activities come second; all other desires to hear sound must follow the necessary priority of a certain class of protected sounds and activities.

Conclusion

In addition to being technically and conceptually problematic, the simultaneous powers of NEMs—reterritorialization and enclosure—are troubling because of the way they shift the terms of our discussion about sound: from the nature and texture of everyday life, to juridical concerns about price and property. Noise, nonetheless, is a legitimate health concern—increasingly so as the world's population continues to expand and urbanize. While NEMs specifically, and Noise Compatibility Programs generally, seem to have good intentions, it is *how* they make noise "compatible" that is troubling. Maps could conceivably be used to help develop political mechanisms encouraging full access to the common, or to empower people to challenge harmful or abusive activities,

or to help establish a human right to territorial quietude. Instead, they have been used to superimpose a price penalty, to ignore the human (and even aesthetic) problem of excessive noise exposure, while leaving specific details to the marketplace.

Hardt and Negri further warn that when the common is accumulated, "its productivity is blocked or lessened."[45] Enclosure is worrisome, then, in more than a few ways. For one, it provides for the continued development of sound as a weapon. Today, military and police forces are granted special access to the common, allowed to produce intense, highly focused sound at ordinarily prohibited levels—both as a form of crowd control and as an "enhanced interrogation" technique.[46] This not only impedes our literal ability to speak and think freely, but endangers our physical ability to congregate, to share ideas in a public forum without the looming threat of sonic violence.

In an even broader sense, enclosure is a concern because it impedes "expression, creativity, and communication," especially as shared social and intellectual resources are emerging as a primary means of economic transformation, social development, and artistic production. In recent years, musicians and artists have made very meaningful use of otherwise common sounds—in sound walks,[47] installation sound art, and other kinds of musical compositions inspired by the environment. Each of these hinges on access to commonly-audible sounds—"natural" or human, mechanical and otherwise—made

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[45] Ibid., 288.

[46] Suzanne Cusick, "Music as torture / Music as weapon," *Trans: Revista Transcultural de Música* 10 (2006) http://www.sibetrans.com/trans/a152/music-as-torture-music-as-weapon (accessed 18 July 2012); "You are in a place out of the world": Music in the Detention Camps of the 'Global War on Terror'," *Journal of the Society for American Music* 2 (2008): 1-27.

[47] Hildegard Westerkamp, "Soundwalking," *Sound Heritage* 3, no. 4 (1974), revised 2001, http://www.sfu.ca/%7Ewesterka/writings%20page/articles%20pages/soundwalking.html (accessed 12 May 2010).

available through clear access to an acoustic environment that is inclusive, participatory, and freely available.

The precedent set by "positive" enclosure stands to undermine these activities and countless others—not to mention the extremely serious threat it poses to the life and wellbeing of non-human animals.[48] But I want to conclude this case study on a positive, if only speculative, note: it does not have to be this way. Indeed, the very reason Lindsey lost his appeal could conceivably become a vehicle for producing change: *community*. Maps were used to define Lindsey as part of a group of people living in Memphis, people who shared a common interest and a common concern. Where, as Hardt and Negri explain, "hierarchies segment the common and exclude populations from it," maps could help us resist enclosure by restoring "necessary forms of cooperation and communication."[49]

More in the spirit of "dynamic" maps discussed in Chapter 2, NEMs could be used to raise our awareness of sound and its role in our lives. They could be used to facilitate "constructive interaction" by becoming a locus for cooperative advocacy, by reasserting the primacy of mutuality of what we share in (the acoustic) common.[50] The ultimate

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[48] J.L. Dowling *et al* explain that "[b]ackground noise presents a challenge for animal communication because it increases the masked hearing threshold ... of receivers and thereby limits the signal's active space." This is especially worrisome, since animals like birds "use acoustic signals for functions like species recognition, mate attraction, and territory defense, making them central to their reproductive success and survival." See: J.L. Dowling, D.A. Luther, and P.P. Marra, "Comparative effects of urban development and anthropogenic noise on bird songs," *Behavioral Ecology* 23, no. 1 (Jan. 2012): 201-09.

[49] Hardt and Negri, *Commonwealth*, 303.

[50] In addition to demanding "open access to the common against the barriers of private property," reform requires of us to demand "equality against hierarchy, allowing everyone to become capable of participating in the constitution of society, collective self-rule, and constructive interaction with others." (Hardt and Negri, *Commonwealth*, 381.)

problem with NEMs, then, is that they actively exclude the ears of ordinary people, favoring instead the mechanized "observations" of computer models. By defaulting to already-institutionalized observations, they are, if not contrary to the interests of what people *actually hear,* then completely indifferent towards it. What is needed, then, is to open these maps to a sense of place. They must reflect what acculturated residents observe (or are annoyed by) and experience (or wish to avoid). To serve the general good, people should be given the right to contest the maps as a regulatory medium—to challenge their history, process, methods, and application. And furthermore, instead of using maps to identify locations in need of acoustic retrofits, an application which treats the symptoms of noise rather than addressing its causes, they should be used to encourage and empower people to challenge the activities that motivate and justify their construction in the first place.[51] Until then—until "everyday" ears and actual, human experiences are found at the center of regulatory noise mapping—the acoustic commons will remain positively enclosed.

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[51] In one notable lawsuit, the Supreme Court of Georgia ruled that the City of Atlanta was justified in compensating only owners of single-family homes for exposure to aviation noise. They ruled that "the city's actions did not violate the state constitution's equal protection provisions because the classifications that were drawn by the city [between single- and multi-family homes] bore a rational relationship to the legitimate governmental purpose of reducing land use that was incompatible with airport noise in a sound and responsible fiscal matter, and the city's decision to purchase single-family residences first was reasonable and not arbitrary." This case raises further serious questions about noise maps, including whether they tend to favor people of certain socio-economic backgrounds. Much more research needs to be done on this subject. See: City of Atlanta v. Watson, 1996 Ga. LEXIS 709 (September 23, 1996, Decided).

Chapter 4: Sound Maps in Music Notation

> Every abstract machine is linked to other abstract machines, not only because they are inseparably political, economic, scientific, artistic, ecological, cosmic—perceptive, affective, active, thinking, physical, and semiotic—but because their various types are as intertwined as their operations are convergent.
> —Gilles Deleuze and Félix Guattari, *A Thousand Plateaus*

Introduction

Sound maps not only represent audible space, they change the terms on which we relate to it. As I argued in Chapter 1, the historical and conceptual roots of this change can be traced to early research into architectural acoustics. While experiments conducted at the turn of the 20th century demonstrated that sound can be predicted, and indeed, controlled with precision, its relationship to space can also be seen as univocal.[1] As depicted in the experimental diagrams of Wallace Sabine, a single room can have within it pockets of varying intensity—suggesting space not only serves as a container for sound, but exerts a creative influence that changes it. It is, in the words of Gilles Deleuze, univocal: singular, but internally differentiated.

One conceptual beneficiary of this research was thematic cartography: maps designed to show the acoustic and psychoacoustic contours of the everyday environment. As I explored in Chapters 2 and 3, sound maps have found a range of applications: from helping to manage the analysis of airport noise to showing how sound contributes to the formation of a community's identity; from becoming an environmental art object to emerging as the object of "sonic" crowd sourcing. None of these maps are self-evident presentations, though. As cartographic historians including Brian Harley and John Pickles

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[1] Emily Thompson, *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933* (Cambridge, MA: MIT Press, 2002).

have argued, sound maps are rather persuasive re-presentations with the potential to shape how and what we hear. As a result, we should adopt a cautious and critical view of sound maps, one that focuses not on the surface of the map, but on the relationships they configure among sound, experience, the environment, and everyday life.

The underlying idea—to combine both sound and space within a single representational frame—correlates also with developments in music. Sound maps, whether composed using textual or visual media, can be found with surprising regularity throughout 20th-century music notation. As a kind of "musical graphic," these images "strive to stimulate without constricting the imagination."[2] Yet, beyond this point, further analysis of what spatial diagrams do and the creative possibilities they engender is almost entirely lacking in scholarly literature today. This chapter will begin to remedy this oversight by taking these images seriously: both as instructions for the performance of music and sound, and as representations of the physical environment.

Sound maps in musical notation take two common forms. In the first section of this chapter, I will explore several cases where maps and diagrams are included alongside more conventional music notation. While there is nothing particularly revolutionary about a seating diagram *per se*, these images do much more than simply instruct performers where to sit; by being closely connected with the broader conception of the "work," they function to outline spatial and sonic relationships that should be actualized (or avoided) in performance. In a few cases, the diagram even becomes a vehicle for actualizing an inconsistent and irregular sonic environment, a space where placement and situation can

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2 Erhard Karkoschka, *Notation in New Music: A Critical Guide to Interpretation and Realisation* (New York and Washington: Praeger Publishers, 1972), 77.

profoundly influence what is heard, by whom, and how. In the second section, I will

examine more extreme examples of sound maps in musical notation: instances where

traditional notation is abandoned entirely, and where maps, photographs, or spatial

diagrams become themselves the foundation of the score. While carefully indicating

where sound should be made, these scores often ignore more conventional musical

concerns—such as which sounds to make, and when to make them. Additionally, these

works are unusual for the way they "enframe" mapped space, setting it aside as already

sonically rich while asking us to perform cooperatively in and with the surrounding

environment.

While sound maps in music notation are used to fill any number of specific

purposes, beneath the surface lies a common, if unarticulated, grasp of the way in which

space gives both literal and metaphorical shape to music and its performance. In treating

these works as primary source documents, I will highlight key examples that ask us to

reevaluate in broad terms what we mean by "writing music." As I will suggest

throughout, these works should challenge not only our preconceptions of how notation

looks, but the way it should be analyzed, and the human, material, technical, and

temporal relationships it is thought to figure.

Section I: Analysis on/of the Periphery?

All of the works discussed in this chapter share a few common features. The first

is representation: in all cases, the score "maps" the site of performance. Sometimes this is

done quite simply, perhaps using a few stick figures or a textual explanation, that

describes how performers and instruments should be situated. In others, the map becomes

a sophisticated tool—a photograph, an explanation, or a carefully drawn technical

diagram—with implications far beyond the placement of chairs. The second common

feature is insufficiency: each map depends on a larger musical context. Where, in some

cases, the sonic aspects of performance are left entirely open—in the more well-

established sense of musical indeterminacy—in others, they are acquired by association

with a more traditional musical score.

Perhaps one surprising place both features can be seen is among the work of

American composer Steve Reich. Perhaps Reich's most important composition, *Music for*

18 Musicians is often thought to mark a key moment in the emergence of musical

minimalism and is significant for the way it "comprehensively explored the possibilities

afforded by ... simple musical process."[3] In being "structured like the extended dance

remixes of pop album tracks," it succeeded, in part, by bringing the domains of "high"

and "low" musical practice closer together.[4] As Robert Fink explains, *Music for 18*

Musicians was

> able to channel and then release musical energy across several variations by
> using two musical devices not usually thought to exist in minimal music: a bass
> line that outlines semifunctional root progressions over large expanses of musical
> time; and a series of coherent, carefully controlled linear progressions in the
> soprano register.[5]

Fink's comments in many respects typify what we expect from musical and theoretical

analysis as it is practiced today. It involves first observing the way a small fragment of

sonic material—a melody, a rhythm, or an idea—is manipulated and developed within the

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[3] Robert Fink, *Repeating Ourselves: American Minimal Music as Cultural Practice* (Berkeley: University of California Press, 2005), 49.

[4] Ibid., 47-48.

[5] Ibid., 50.

abstract realm of musical "space-time," within the theoretical domain of the text.[6] These

observations might later be reconnected with others about culture, society, or the life of

the composer.

While this mode of analysis continues to be important, it tends to leave some

aspects of the score unscrutinized; parts that seem structurally unnecessary are considered

outside the domain of "space-time," and thus are beyond the analytical gaze. This is

especially true in the case of *Music for 18 Musicians,* whose introductory material

includes a seemingly self-explanatory staging diagram. Drawn with surprising detail,[7] it

consists of figures and shapes of varying sizes, representing people and musical

instruments—vibraphones, pianos, and clarinets, among others. The arms of each human-

like image are shown outstretched—and in the case of percussionists, with mallets in

hand, as though in the act of performing. Nearby, a brief text explains that the image

shows a "suggested arrangement" for performance, a qualification that leaves open the

possibility that some other orientation might work, too, depending on how (and how

well) the performers communicate with each other. (Figure 4-1) Initially at least, it is not

clear why this image is included with the score at all, or indeed, whether it has some

special role to play beyond mere "suggestion." After all, the arrangement shown is

neither so unusual nor so obscure that performers could not discover it independently. It

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[6] Evan Jones provides a fascinating overview of different forms of what he calls spatial-temporal notation. While some are linear, others "posit new kinds of adjacencies or modes of succession." It is important to note, however, that "cartography" in his article becomes entirely metaphorical. See: Evan Jones, "Mapping Musical Space," in *Mapping in the Age of Digital Media: The Yale Symposium,* ed. Mike Silver and Diana Balmori (West Sussex, UK: Wiley-Academy, 2003), 66.

[7] Steve Reich, *Music for 18 Musicians* (New York: Boosey and Hawkes, 2000).

is, by any conventional assessment, a familiar and practical setup: pianos and percussion located near the back, and singers with winds near the front.

Within the frame of musical analysis at least, the silence surrounding this map is indicative of what Lydia Goehr has called the "separability principle"—"the custom to speak of the arts as separated completely from the world of the ordinary, mundane, and everyday."[8] She explains:

> The separability principle was abundantly used by theorists around 1800. It was used to redefine various major distinctions: those between art and nature, art and craft, and the civilized and the popular; various aesthetic notions: artistic form, content, and medium; and various activities: the creation and reception of fine art. Each use of the principle ... ended up pre-supposing, demanding, or referring indirectly to one thing: the existence of an artwork at the centre upon which one's aesthetic concerns could focus.[9]

As Goehr suggests, analysis has historically required insulating the "artwork at the centre" from the noise that surrounds it: nature, craft, "the popular." And while the definition of analytical noise has changed over time, the problem remains establishing what "is" and what "is not" important for analysis—and by extension, determining where "the work" ends and the rest of the world begins. In this particular instance, it is assumed the map appears so "ordinary" that it neither needs nor deserves further consideration. Its impact is therefore marginalized, contained by the introductory pages of the score, going absolutely no further than the resident stage technician at the performance venue.

But, if this is true, then other maps included among Reich's published works should also be ignored. Another similar map can be found in the score for his

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[8] Lydia Goehr, *The Imaginary Museum of Musical Works* (Oxford: Oxford University Press, 1994), 157.

[9] Ibid., 159.

controversial piece *4 Organs.*[10] Like the map used in *Music for 18 Musicians*, this one

includes textual instructions: the image, they explain, shows where the "electric organs,

maracas, amplifiers and loudspeakers *should* be set up..."[11] (Figure 4-2) But the map

itself goes even one step further, providing rudimentary technical instructions addressing

not only where each piece of equipment "should" be put, but how to connect them all

together. For example, the two organists at the front should be connected to the amplifier

at stage left; the organists near the rear should be connected to the amplifier at stage right.

From there, the sound is further split: the front-right organist is connected to the speaker

on the inside, stage right; the front-left organist is connected to the speaker on the inside,

stage left; and so on. This diagram consequently emerges as more than a simple "seating

diagram." It concerns not only where people should sit, but how to produce an effective

result; it provides technical information designed to ensure that the performance sounds a

certain way. These details might, then, explain why the accompanying instructions adopt

the imperative "should," rather than the more lenient "suggested."

Visual representation, of course, is not the only way to communicate this type of

information. For one, Alvin Lucier commonly relies on textual maps to achieve similar

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[10] In her interview with Steve Reich, Terry Gross quotes Michael Tilson Thomas' recollection from an early performance of the work:

> *In all my years as a performer, I have never seen such a reaction from an audience. There were at least three attempts to stop the performance by shouting it down. One woman walked down the aisle and repeatedly banged her head on the front of the stage wailing: "Stop! Stop! I confess!"' The audience made so much noise that, in spite of the fact the music was amplified, we were unable to hear one another's playing. ("Steve Reich at 70," by Terry Gross, Fresh Air, WHYY Philadelphia, 6 October 2006 (accessed 22 May 2012), http://www.npr.org/templates/story/story.php?storyId=6209213).*

If this recollection is indeed correct, it suggests the woman beating her head was doing so *behind* the performers—no doubt a troubling and disruptive occurrence.

[11] Steve Reich, *Four Organs* (London: Universal Edition, 1980); italics mine.

ends. His score for *Kettles,* for example, provides a mixture of technical, practical, and acoustical directions, gathered (perhaps inaccurately) under the umbrella of "Set-up." Lucier writes:

> 5 timpani may be placed up to 10 feet apart in a shallow curve across the front of the stage. A pair of loudspeakers are positioned at shoulder height behind them. In non-proscenium spaces, however, they may be positioned in other configurations which favor the creation of audible beats.[12]

The implications of what Lucier writes here are nominalist: beneath the articulated surface, there is at least one particular configuration known to produce the sonic effect he has in mind. In spite of being apparently optional, then, the instructions function more strictly: everything written after the first "may" casts long shadows of words like "should" or "needs to be." And indeed, the end result, "the creation of audible beats," is so specific—and one can imagine, so liminal—that proper implementation takes on a sense of urgency. At the same time, the word "may" also suggests other arrangements, yet undetermined, might produce similar results; and these arrangements would be acceptable, too, so long as they "create beats." Lucier therefore grants permission to the performer to play with space (and in it) to find alternatives when necessary.

But maps, either visual or textual, are not used simply to provide technical and effective instructions. Even comparatively simple works—those using "low-tech" instruments and equipment, for instance—also make use of them. The score for Reich's *Music for Pieces of Wood* not only "urges" performers "to find and tune" specific claves, but features a map showing where each performer, using each clave, might be placed during performance. Meanwhile, as before, an accompanying text explains that "[p]

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[12] Alvin Lucier, *Kettles: for five timpani and two slow-sweep pure wave oscillators* (Material Press: 1988); italics mine.

erformers *may* stand while playing as illustrated in the drawing and photo below."[13]

While the explicit goal of this directive is to "allow [performers] to hear and see each other clearly," the arrangement is one nearly any classically-trained musician would choose almost instinctively: performers are shown in a slight arc facing the audience—a set up meant to enhance ensemble clarity and ease communication among players. (Figure 4-3)

   In addition to complicating the notion that music can be understood analytically simply by studying "space-time," maps like these have implications far beyond ordinary concerns: the physical situation of performers, or the technical configuration of instruments and equipment. Despite seeming banal or obvious, they are important because they bring the assumptions of notation—its tangibles, including the very existence of human bodies and physical space—into the foreground. When filled with rich information about the materiality of performance, maps subsequently complicate the very notion that music can be removed from lived experience—or as Goehr wrote: "the ordinary, mundane, and everyday."[14] Despite being physically and conceptually bracketed, located among "introductory" materials, maps in musical notation should challenge us to reconsider the boundaries of the musical "score."[15] No longer a uniform block consisting solely of staves, measures, dynamics, and rhythms, it emerges as a much

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[13] Steve Reich, *Music for Pieces of Wood* (London: Universal Edition, 1980); italics mine.

[14] Goehr, *The Imaginary Museum,* 157.

[15] "Score," in the Grove Dictionary, is defined as a "copy which shows in ordered form the parts allotted to the various performers, as distinct from 'parts' which show only that of one performer." This is no longer an adequate definition, since a spatial graphic is neither a single "part," nor a highly condensed reduction of several. See: "Score," in *The Oxford Dictionary of Music,* 2nd ed. rev., edited by Michael Kennedy, Oxford Music Online, http://www.oxfordmusiconline.com/subscriber/article/opr/t237/e9188 (accessed May 23, 2012).

larger assemblage—a notational complex—composed of various types and modalities of instruction: graphical and textual, spatial and temporal, able to reference not just sound, but instruments, machines, and bodies. For musical analysis, conventionally understood, the effect of this expansion is important and profound. While older forms of theoretical praxis, focused, as they are, on pitch content and rhythm, may have a somewhat changed role, I want to suggest that the persistent appearance of maps throughout published musical notation in the 20th century can no longer be ignored.

Maps can be used to guide the purposeful creation of a new environment, one that ensures not sonic regularity or consistency, but that sound will be heard differently and unevenly from place-to-place. The score and maps I will survey in the remainder of this section, all of which implicate space, continue to utilize the traditional five line clef. Nonetheless, much as I discussed in Chapter 2, it is the way in which the image of the map intersects with the materiality of performance and notation that should be the object of analysis. My focus, as a result, will be trained on the threads and sinews that connect each map to the more conventional aspects of the score. Throughout this chapter, I will show how sound maps, as a form of musical notation, both figure and pre-figure a complex series of relationships linking performers to the physical environment and the audience. In some cases, the maps are flexible—one or two possible configurations might be possible, both of which create an effective environmental "texture." In other cases, the image must be carefully avoided: the configuration shown is too conventional, too predictable, and otherwise not capable of producing a particular outcome.

Positives and Alternatives

In a literal sense, the maps of Reich and Lucier are minimally restrictive since they are accompanied by equivocating terms like "may" or "should." This grants performers tacit permission to experiment with new spatial contexts and to accommodate unforeseen performance constraints—just so long as their eyes and ears remain fixed on the final effect. At the same time, there is nothing inherent to the idea of a map to prevent it from being used more strictly. Indeed, to the extent the maps I have discussed so far are somewhat more than optional, and at the same time, somewhat less than fixed, others are far more clear about which spatial considerations are necessary and required in performance, and alternatively, which can be (or must be) ignored or rejected.

Iannis Xenakis exemplifies the former. His maps are clearly defined and rigidly organized, although his decision to notate space so explicitly is perhaps not terribly surprising given his personal history and creative ambitions. Xenakis first developed his reputation as a composer of "spatial music" thanks to his work on the Philips Pavilion during the late 1950s.[16] He then spent much of his later career working with site-based and installation art, often with the expressed aim of developing novel ways to reconnect and reintegrate sound with space, light, and architecture. It was in this context that Xenakis devised an important concept, one that framed theoretically how space and sound could be utilized co-productively: the polytope. Made by combining together the Greek words for "many" and "space," the goal of a polytope—one shared with electronic spectral music as it developed during the 1960s and 70s—was to project sound into

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[16] For a broad but thorough overview, see: Marc Treib, *Space Calculated in Seconds* (Princeton: Princeton University Press, 1996).

different areas of the performance environment.[17] As musicologist Philipp Oswalt has

written, the dynamic and immersive result was meant to create "an overlapping of many

sound spaces" such that

> [e]ach listener perceives the music in a different way according to his or her
> location at the time. The acoustical space is no longer homogeneous, but divides
> itself into different spatial areas.[18]

Xenakis first deployed the polytope in his work *Terretektorh*. Crucially, however, the

means of projection was not speakers or electronics, but rather human performers.[19] In

the score, provisions are made to install them carefully within and throughout a tightly-

circumscribed performance environment. The included map—a visually striking one,

more resembling a scatterplot than a seating chart—shows a large circle divided into

eight slices, labeled A through H, each referring to a discrete group of performers and a

portion of physical space. (Figure 4-4) The conductor, positioned in the center of the

circle, is surrounded by large dots, each numbered and labeled, showing a careful

dispersion of performers throughout the surrounding space. Only the percussion section is

situated on the periphery, just beyond slices A, D, and G. The remainder of the diagram is

filled with small, regularly-distributed and seemingly insignificant flecks representing the

"Public," which consequently surround and envelop the performers.

This map is more than merely orientational, though, and actualizing it is anything

but voluntary. On the contrary, the configuration of the physical environment might well

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[17] Gascia Ouzounian, *Sound Art and Spatial Practices: Situating Sound Installation Art Since 1958* (Ph.D. diss., University of California San Diego, 2008), 53.

[18] Philipp Oswalt, "Iannis Xenakis' Polytopes," translated by Tas Skorupa, *Contemporary Music Review* 21, nos. 2/3 (2002), 39.

[19] Iannis Xenakis, *Terretektorh: Pour Orchestre* (Paris: Editions Salabert, 1969).

be considered an integral feature of *Terretektorh*, since spatial position could have a

profound (and not always positive) influence on the performed outcome—even as

experienced by the audience. The result in one instance was recalled by musicologist and

critic Brian Dennis:

> [t]he first single note played by a solo viola revolved clockwise round the hall;
> moving regularly in a quasi-canon, it was to make two full circuits before further
> development ensued. This kind of linear circular movement with the instruments
> of a given kind not grouped together but situated at regular spacings around the
> instrumental arena could not nearly so easily be assimilated from the gallery, so
> that the second performance was for me, having moved from my former position
> on the floor, definitely less effective.[20]

Placed alongside Dennis' description, the map functions not to help create a smooth or

consistent "whole"—a performance setting, for instance, often idealized by the modern

symphony hall.[21] On the contrary, instead of ensuring an identical seat and sound for

everyone, the diagram facilitates the creation of a dynamic and, more importantly,

inconsistent sonic space. The planned outcome was for a performance environment where

the location and interaction among performers and listeners creates a certain amount of

variability. Moving from fleck to fleck, or from slice to slice, would, by design, result in a

different experience for listeners and performers alike. Consequently, though perhaps

inadvertently, the map prefigures what Oswalt explained earlier: the emergence of space

as a non-homogeneous "whole."

At the same time, Dennis' description also foregrounds a significant challenge

inherent to the spatialization of sound. To be effectively manipulated, to create a textured

and heterogeneous performance environment, everything has to be physically, and in the

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[20] Brian Dennis, "Xenakis's 'Terretektorh' and 'Eonta'," *Tempo* 82 (Autumn 1967), 27.

[21] For instance, see Edward Rothstein's comments in Chapter 1, pp. 20-21 and 28.

case of people, corporeally managed. This is a crucial point, since, as Dennis recalled,

being outside the designated envelope could have disappointing or at least unanticipated

results. A performance could conceivably "go wrong" not because of more usual

problems like wrong notes or poor conducting, but because otherwise "non-performing"

participants drifted outside their designated area. Consequently, a map like the one in

Terretektorh can be said not only to make provisions for the placement of performers and

instruments, but to expand the field of notational control, blurring conventionally-

understood and long-established boundaries between performer and auditor. In this

particular example, every *body* has some place to be.

Xenakis' notation, in this respect, resembles other kinds of so-called "spatial"

music, including polyphonic choral music, whose relevant similarities surface with

particular clarity in the study of St. Gertrude's Chapel in Hamburg. Built in the late 14th

century, damaged by fire and refurbished in 1607, then completely destroyed in 1842, St.

Gertrude's was home to some of the most well-known artists and performers of its time.

Matthias Weckmann, Thomas Selle, and Georg Telemann all composed music for

performance in St. Gertrude's, and at times, performed there themselves.[22] While the

building's distinct octagonal shape is shared by other pilgrimage chapels of the era,[23] the

special significance of St. Gertrude's lies with its identity as a historical locus for musical

performance. As musicologist Frederick Gable writes, "[d]uring the first half of the 17th

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[22] Frederick Gable, "St. Gertrude's Chapel, Hamburg, and the Performance of Polychoral Music," *Early Music* 15, no. 2, Plucked String Issue (May 1987), 230.

[23] Ibid., 230.

century," St. Gertrude's became "the favourite setting in Hamburg" for the performance

of polyphonic Passions.[24]

Expanding a line of argument common to the "authentic" performance practice

movement, Gable argues that "the physical characteristics of the building for which a

particular piece of music was written must be considered an essential element in any

attempt to recreate the *aesthetic impact* of that piece."[25] It follows that studying St.

Gertrude's architecture can help us answer important questions about the spatial

dynamics of musical performance in the past, and by extension, about "the appropriate

environment for the performance of polychoral music" today.[26] Gable subsequently

models a number of practical and logistical questions. For instance:

> Where should [each polyphonic ensemble] be located in order to enhance the
> musical effect and to avoid causing problems of coordination, balance and clarity? In
> large churches a rear organ gallery is usually too distant from the Choir, while
> transept or side balconies may be out of sight of the performers in the Choir and thus
> impractical. As some accounts suggest, special platforms built in the nave may be
> one solution, or it is possible that these three- and four-choir works were designed for
> performance in smaller buildings than is commonly assumed.[27]

The underlying puzzle of St. Gertrude's, however, is rooted not merely in its physical,

historical, or architectural dimensions. An important assumption buttressing Gable's

notion of "aesthetic impact," and indeed, the reason that impact needs to be actualized

today, is that some kind of impression—spatial or musical, acoustical and otherwise—

has been left on the text, coded subconsciously or unconsciously, within or beneath it.

These traces must furthermore be excavated if we ever hope to understand either the

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[24] Ibid., 231-32.

[25] Ibid., 229; italics mine.

[26] Ibid., 238.

[27] Ibid.

music (considered in the abstract sense of the separability principle) or the time period during which it was written. And indeed, these become especially problematic considerations where someplace like St. Gertrude's is concerned, since so few physical remnants of the space remain.[28]

Xenakis' map for *Terretektorh,* meanwhile, seems to implicitly embrace many of Gable's most fundamental assumptions about "aesthetic impact" while taking them in a decidedly more tangible direction. Which is to say, the fact Xenakis included a map at all suggests physical, spatial, and sonic interdependencies do not have to be excavated: they exist, on the surface, for everyone to see. But the clarity with which space is implicated in turn raises a practical question, one that is only ever implied by Gable's study of St. Gertrude's Chapel: Can a performance of *Terretektorh* continue in circumstances when the spatial directive cannot be actualized? Xenakis' score, like those of Telemann or Selle, is otherwise silent about the answer. Implied is a certain amount of personal risk and responsibility: for each person to do what, and be where, the notation specifies. Indeed, as Dennis' recollection makes clear, a "bad" performance could be defined as much by the misplacement and misperception of the audience as poor execution by the performers.

Other compositions by Xenakis, however, are far more clear on the answer to this question, including the aptly-named *Polytope.* This orchestral work by Xenakis was written for a specific place and occasion: the French Pavilion at Expo '67 in Montreal,

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[28] For a highly condensed overview of the "authentic" music debate, see: Nicholas Kenyon, ed., *Authenticity and Early Music,* (Oxford and New York: Oxford University Press, 1988).

Canada.[29] While the building's primary function was not to exhibit cutting edge consumer electronics, it did nonetheless share some superficial resemblances to the Philips Pavilion from nearly a decade earlier. The exterior featured a striking glissando of steel and glass, which wrapped around the building while ascending toward the roof. But where Xenakis, in this case, had no say in the physical design of the building, he was granted complete control of the spectacle meant to be performed inside it. *Polytope*—not unlike Varèse's earlier *Poème électronique*—was meant to be performed in the central atrium of the building, which featured a large sculpture, crisscrossing staircases, and a central fountain. *Polytope* was conceived, then, as a fully-integrated spectacle, one where the senses benefit from a synergistic confluence among light, sound, and the physical environment, all of which work together to create an experience that none on its own could achieve.

The score for *Polytope* includes a map showing a large square divided into four quadrants. The orchestra is placed along the central "t," and the audience—here represented using a single, uninterrupted scribble—fills in the remaining space. (Figure 4-5A) What makes this image significant, and indeed quite different from the earlier example in *Terretektorh*, is the second arrangement that accompanies it. (Figure 4-5B) Rather than saying, more simply, that the first arrangement "may" be used—the solution favored by Reich and Lucier—the second diagram shows exactly how the performers and audience should be situated in the event the first map cannot be actualized. And this

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[29] Iannis Xenakis, *Polytope* (London: Boosey and Hawkes, 1969); *EXPO '67: The Memorial Album of the first category universal and international Exhibition held in Montreal from the twenty-seventh of April to the twenty-ninth of October nineteen hundred and sixty-seven* (Thomas Nelson & Sons, 1968).

version depicts a far more conventional arrangement, with performers staged in columns opposite an audience—winds and strings near the front, percussion and brass to the back. Presumably not meant for use in the French Pavilion, this version is generic enough for circumstances when a more familiar "oppositional" seating arrangement is preconfigured: a concert hall, an auditorium, a church, etc.

Of course, at some level, this map might illustrate nothing more than Xenakis' hope that *Polytope*—unlike the earlier *Poème*—would acquire an active and vibrant performance life outside the French Pavilion. And indeed, following the end of Expo '67, the Pavilion was transformed into a casino, making any future performance of *Polytope* there unlikely.[30] But whatever his motivation, leaving the physical environment undetermined, unscripted, or at the very minimum, un-notated seems to have been inadequate. Space, for Xenakis, had to be planned for; and by providing two discrete possibilities—rather than one or none—the resulting sonic and spatial relationships are written-in to the score through a bifurcated exclusion. There is no "may" or "should" to be found, and there is little or no room for performative experimentation: it is either *this* arrangement, or *that* one.

Negatives and Prohibitions

Whether implied or explicit—whether written during the 17th or 20th century—one point on which all of the scores I have discussed so far agree is that notation functions in the affirmative: it says, to some degree, what should be done. But this is not always the case. Some composers are both explicit in their spatial notation and, at the same time, clear about the inadequacy of alternatives. One perhaps surprising example can be found

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[30] Québec's casinos, http://www.casinosduquebec.com/en/home (accessed 23 May 2013).

in the work of Pauline Oliveros, whose music is often celebrated for its embrace of a

feminist and environmentalist ethos. Her score for *Aeolian Partitions*, however, also

makes prominent use of a map—and in this case, its actualization is anything but

optional. (Figure 4-6) Nearby textual instructions detail three of the most essential

considerations for performance: there should be a stage, preferably one with a

proscenium arch; an overhead projector will be needed, as will a screen mounted to the

rearmost vertical surface behind the performers; and the theater itself should be capable

of producing a "total house and stage blackout"—necessary to ensure that the "volt

flasher lamps" will produce the proper effect. Crucially, if these conditions cannot be

met, the performance is to be abandoned entirely.[31]

These instructions, and the image that accompanies them, are peculiar. Most

musical notation is not buttressed by a requirement, implicit or otherwise, to abandon a

performance if a particular ideal cannot be guaranteed in advance—that is, to the extent

anything resembling an "ideal performance" can be imagined. Furthermore, where

someone like Reich or Xenakis provides instructions by suggestion and demonstration—

offering alternatives when not more simply labeling as voluntary the ones provided—

Oliveros here raises the stakes: the only acceptable conditions are detailed in the score,

and no others are satisfactory. Whether the reasons for this strictness are political or

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[31] Pauline Oliveros, *Aeolian Partitions* (Brunswick, ME: Bowdoin College Music Press, 1970).
While recognizing the importance of alternative, non-scored ways of composing music, she
nonetheless acknowledges that "the score ... is a symbol of control, a metaphor of control. If
you write a score, then you've got control, so to speak..." (Pauline Oliveros and Fred Maus, "A
Conversation about Feminism and Music," *Perspectives of New Music* 32, no. 2 [Summer
1994], 184) *Aeolian Partitions* demonstrates this, and to powerful effect.

acoustical, the effect is the same: the notation presents an all-or-nothing dilemma, one that is striking for its absolute finality.

Explicit conditionality, what amounts to a spatial ultimatum, is certainly an unusual feature of this work, especially given Oliveros' broader reputation. But she is by no means the only composer to utilize sound maps as a "negative" instruction. Composer Henry Brant is comparatively more well known for his interest in the creative synergies of music and space; that he provided detailed spatial instructions among his scores is not likely to be a surprise. As musicologist Virginia Anderson has written:

> Karlheinz Stockhausen claimed that he had invented spatial music with Gruppen (1958), but Brant's spatial music was both earlier and more complex. Brant experimented with the properties of space, including aspects of direction, projection, spill (the interaction between two group sounds), density, and the perception of movement. He had written 112 spatial pieces by 2003.[32]

Throughout his career, Brant argued passionately that composers have yet to fully explore the musical potential of sound-space interactivity.[33] And indeed, his own works usually include some sort of "spatial plans"—textual or graphical maps that specify how musicians and the audience should be situated, in relation both to one another and to the physical performance environment.[34]

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[32] Virginia Anderson, "Henry Brant: experimental composer who scored for instruments ranging from massed trombones to kitchenware," The Independent (London), 2 May, 2008.

[33] Henry Brant, "Spatial Music Progress Report," (1979) http://www.jaffe.com/ BrantSpatial1979.pdf (accessed 22 February 2012), 2; Brant believed that spatial music "is still isolated from the main currents of musical thought and practice and cannot yet be said to represent a movement or tendency among composers. The more prominent composers now before the public have not adopted spatial techniques as an established element in their music, which may explain why writers on musical subjects have little to say about spatial musical concepts."

[34] Ibid., 4.

Far from exotic Pavilions or multimedia light sculptures, however, Brant usually

assumes the setting for his works will be a modern concert hall, whose familiar structure

and predictable limitations, he believed, could provide a useful constraint for

experimenting with ostensibly "new" sonic-spatial possibilities.[35] For example, his score

for *Ice Field*, which is considered among Brant's finest compositions, features textual

instructions that explain how strings, harps, pianos, timpani, and organ are to be "on

stage," while piccolos, horns, and other assorted wind instruments and percussion are to

be situated "in the hall"—"in the opposite corner, in the first balcony," or in "a series of

boxes," or, at the very minimum, "behind the audience at the downstairs level."[36] The

striking outcome in performance was described by Robert Everett-Green, a music critic

for *The Globe and Mail*:

> Clusters of musicians surrounded the audience, with strings, harps and piano at
> the front, brass and percussion in the side aisles, and woodwinds in the rear
> gallery. From these positions, they launched what seemed at various times like a
> debate, a shouting match, or a tentative meeting of spirits across the intervening
> space.[37]

In an otherwise unfavorable review, Joshua Kosman writing for the San Francisco

Chronicle likewise notes how the work used "every nook and cranny" of Davies Hall:

> At first, there is surprise and a certain amount of delight as the piece bounces
> exuberantly around the place in a winningly low-tech version of Sensurround.
> And it does inspire one to wonder why more composers don't take advantage of
> music's physical dimensions .... After the musical thread has been passed
> around a few times, a listener begins to long for some substance, only to

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[35] Ibid., 2; Brant also believed that the concert hall could become the site of aggressive architectural experimentation. He wrote: "a hall specifically designed to accommodate the spatial music of the past, present, and future, a space with moveable walls, floors and ceiling, is still a project for the future."

[36] Henry Brant, *Ice Field: Spatial Narratives for Large and Small Orchestral Groups* (New York: Carl Fischer, 2002), 4; Brant was awarded the Pulitzer Prize for *Ice Field* in 2002.

[37] Robert Everett-Green, "Giving music some space," *The Globe and Mail (Canada)*, 3 December 2005, sec. R, p. 21.

encounter a soupy string chorale and a jazzy brass outburst lifted from "West Side Story."[38]

But other works by Brant aim likewise to create novel spatial effects; except, instead of a textual map, they include graphics. A brief orchestral piece, the score for *Verticals Ascending - After the Rodia Towers* depicts the position of two "widely separated" ensembles—a clear homage to the titular Los Angeles landmarks. Beyond this general requirement, however, Brant details a few specific ensemble configurations that would qualify as acceptable. In one, the first group of performers would be situated on stage, with the second placed at the back of the hall: in an open balcony if possible, but explicitly not beneath an overhang. In another, both groups could be situated on opposite lateral sides of the hall—a sufficient separation, if only a narrow one, requiring no use of a stage or balconies at all.[39]

The score itself features a pair of maps; and what makes them significant is how they function: where the first shows an "acceptable distribution" of performers (Figure 4-7A), the second depicts an arrangement that is "contrary to the composer's intention and is specifically not authorized."[40] (Figure 4-7B) The latter is particularly striking, since it features what would otherwise be a conventional performance configuration: much like the alternate map in *Polytope*, or indeed, the primary map for *Music for Pieces of Wood*, this one shows two orchestras seated next to each other, forming a slight arch, facing an audience. Despite how comfortable the performers might feel in this

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[38] Joshua Kosman, "Brant's 'Ice Field' spreads across Davies," The San Francisco Chronicle, 14 December 2001, sec. D, p.5.

[39] Henry Brant, *Verticals Ascending after the Rodia Towers* (New York: MCA Music, 1969), 2.

[40] Ibid., 3.

arrangement—and despite how smooth and consistent the ensemble might sound—the unequivocal message is that habit and tradition are not always to be trusted. In some cases, the goal of a performance is neither smoothness nor convenience. Indeed, the goal in this case seems rooted in univocality: the creation of a textured space, one that can be heard and experienced differently from place to place; the emplacement of an unconventional performance arrangement, one that promotes a productive interaction among the performers, the auditors, and the surrounding environment.

Even more generally, though, Brant's unusual negative instructions should cause us here to reconsider, in the broadest possible terms, the modality of notation. Usually, it is thought to tread a careful, sometimes fuzzy, line between "prescription" and "description"—between showing what *ought* be done and documenting, however crudely and imprecisely, what *was* done.[41] Beyond this binary, it usually goes without saying that notation functions positively: a note appearing on the "F" line does not mean to play an "E"—except, perhaps, in the case of a transcription error or an indecipherable note. In *Verticals Ascending*, however, something entirely different happens. As the notation forecloses—visibly and indisputably—a familiar and comfortable spatial situation, it simultaneously introduces a third term: not only can notation balance prescription with description, but also with prohibition.

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[41] John Spitzer and Neal Zaslaw argue that a similar distinction, though muddied and complex, applies also to representations of seating and placement. (John Spitzer and Neal Zaslaw, *Birth of the Orchestra: History of an Institution, 1650-1815* [Oxford: Oxford University Press, 2004], 345.) In addition, a fascinating investigation into the gap between "prescription" and "description" at the intersection of notation, music theory, and modern recording technology can be found in: Alexander Rehding, "Wax Cylinder Revolutions," *The Musical Quarterly* 88, no. 1 (Spring 2005): 123-60.

Relation to Earlier Forms

An important question to consider is whether these images really are "sound maps" in the same sense as environmental maps or acoustical diagrams. The answer, I believe, is yes; and the reason can be traced to the definition I proposed in Chapter 1. "Sound maps," I suggested, are defined not only by their surface appearance (i.e. their relative map-ness) or by their prospective uses (e.g. navigation, way-finding, etc.). They are defined also by the extent to which they reflect an awareness of the dynamic world in which they operate. Which is to say, sound maps do not merely show the world, they ask us to appreciate and value it in a certain way, by viewing the relationship between sound and space as internally differentiated—what Deleuze and Guattari call "univocal." In doing so, they resist absolute universalization while simultaneously reflecting a distinct way of thinking about the environment and making use of it. Sound maps in musical notation, particularly well-exemplified by Xenakis' score for *Polytope*, expect aural difference without, as Oswalt suggests, imposing homogeneity.

In that sense, these musical scores are sound maps, not only in a superficial sense —because they utilize rudimentary forms of spatial representation—but because they embrace the creative influence of the physical environment. Space, they suggest, is not only someplace to be played *in* but a medium to be played *with*. It consequently has to be configured differently from performance to performance, from site to site, not just for logistical reasons, but for acoustical and even political ones. This means, in some instances, that only one or two physical situations are acceptable; in others, different arrangements are possible, and performers are allowed to experiment until they find one that works. But the end result in either case is by no means Platonic. It is rather a

contextually and circumstantially limited configuration—ideal, perhaps, but only

contingently. So, while Brant stipulates clearly a "forbidden" arrangement, and Oliveros

requires abandonment if the prescribed conditions cannot be met, the approved

alternatives are not universally desirable. They "work," but only for one piece, one

context, perhaps only one physical site.

By comparison, some seating diagrams function in precisely the opposite way:

they foreclose both space and experimentation in pursuit of a singular ideal. One notable

and important example is the diagram of the Dresden opera made by Jean-Jacque

Rousseau. (Figure 4-8) This image, first published in Rousseau's *Dictionary of Music*

from 1775, and subsequently widely reproduced, shows the "first orchestra in Europe" to

be "best distributed, and which form together in the most perfect manner."[42] It is

presented not just as a visual aid or a descriptive representation of a particular

performance, but as an almost scientific demonstration, one that can be used to assess the

"whole distribution" of the orchestra.[43] Rousseau explains what this means:

> [T]he true distribution of an orchestra is a care not to be neglected. We owe in
> great part to this care, the astonishing effect of the symphony in the operas of
> Italy. The first, attention is paid towards the fabric of the orchestra, that is, of the
> materials which it contains. They give it propositions proper for the symphonists
> to be most assembled and distributed in the proper manner. They take care to
> make the case of it of a light thin wood, to establish it on a vide, with arches for
> supporters, to remove the spectators from it by a partition placed in the pit, at a

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[42] Jean-Jacques Rousseau, "Orchestra," *A Dictionary of Music*, translated from the French by William Waring (London, 1775), 302.

[43] Spitzer and Zaslaw point out, however, that other theorists and performers during this time period seemed to be more flexible in their expectations for placement and seating. They point out that "[Francesco] Galeazzi, comparing [two different seating plans for an orchestra placed in a pit], remarks that the Dresden layout is better for maintaining ensemble but that the Turin plan is better for projecting a uniform orchestral sound to every corner of the theater." (Spitzer and Zaslaw, *Birth of the Orchestra*, 352.) Needless to say, sound "phasing" was not viewed as something positive: in the first case, it had to be dealt with and accepted; in the second, it could be avoided. But the ideal, in either case, seems to be the same: uniformity, whether at close or distant range.

foot or two distance, so that the body of the orchestra, being in a manner borne in the air, and touching hardly any thing, vibrates and resounds without any obstacle, and acts as a large instrument, which answers to all the rest, and increases their effects.[44]

As explored here, the most important reason to exert spatial control is to enhance the orchestra's sound—that is, a reified orchestra: any or even all of them. Much like a violin or cello individually, the orchestra is described collectively as sounding like a single instrument—a vibrating body that needs not only time and physical space to resonate, but a certain material context. It is for this reason the orchestra must be carefully separated from the audience by "thin wood," which functions not only protectively—since touching the orchestra would, no doubt, dampen its sound—but to harness its collective vibrations. As a barrier, the wood serves a dual purpose: not only is it a functional division, but a political one that inscribes the distinction between "us" and "them" into the physical space of performance.[45]

Rousseau's comments may seem entirely unremarkable, since they present a view that was generally accepted as true for the time.[46] Significant, nonetheless, is the way

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[44] Rousseau, "Orchestra," 302.

[45] Some critics have found such divisions problematic. For instance, see: Christopher Small, *Musicking: The Meanings of Performing and Listening* (Hanover, NH: University Press of New England, 1998).

[46] Spitzer and Zaslow go one step further than Rousseau, arguing that the development of orchestral placement can be understood in terms of acoustics. They write:

> [I]n a large room like a theater with a high ceiling, the sounds of the orchestra tends to dissipate upward; in addition much of the sound will be absorbed by the spectators and by the upholstered interiors of the boxes. Placing the orchestra in the pit helps to address these acoustical problems. (361)

This assessment—though certainly technically accurate—is nonetheless ahistorical. The relationship between upholstery and absorption, for instance, though commonly understood today, was not established until the late 19th century. See: Wallace Clement Sabine, *Collected Papers on Acoustics* (Cambridge, MA: Harvard University Press, 1922).

they identify (what Rousseau thinks is) an idealized orchestral sound and (what he understands as) universally-applicable principles—which can themselves be translated or transferred onto any particular space. And in that sense, Rousseau's remarks have a further implication: they can be used to determine the "best" seat for each member of the orchestra individually.[47] "In regard to the interior distribution," Rousseau writes:

> we must be careful, first, that the number of each kind of instruments be proportioned to the effect which they should all produce together; that, for instance, the bass should not be stifled by the treble or stifle it; that the hautboys should not predominate over the violins; neither the seconds or the firsts. Secondly, that the instruments of each kind, except the basses, should be collected together, for them to agree and move together with more exactness. Thirdly, that the basses be dispersed around the two harpsichords, and throughout the orchestra, because it is the bass which should direct and sustain all the other parts, and all the musicians should equally hear it.[48]

These directions might be read in one sense as broadly symptomatic: yet another imprint of continuo practice, though left this time on the spatial environment. Indeed, what Rousseau describes here as the ideal orchestral arrangement—one that remains ideal regardless of any local or specific constraints—is where both bass and harpsichord are a pervasive presence, acting as a physical, literal, and sonic scaffold around which the rest of the orchestra is built.

Put in a limited context, this diagram, and the explanation that accompanies it, might be read as foregrounding how space and sound are, in fact, mutually implicated. But given the broad, universalizing justification Rousseau provides, I want to suggest the opposite: unlike Xenakis or Brant, the physical environment for Rousseau is not something to be played with, but rather contained: made subordinate to a particular sonic

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[47] Rousseau, "Orchestra," 344.

[48] Ibid., 302.

ideology. Space is not valued for its internal or creative differences; it is rather thought to present practical, material, and even political hurdles that must be overcome, worked-through, and forced into alignment with a coherent musical logic.[49] In that sense, Rousseau's diagram behaves more like aspiration than notation, diagramming an idealized musical-spatial utopia.

At the same time, it is important to acknowledge how the maps of Brant, Xenakis, and others, do exert control—over space, over bodies, over sound. What separates them from Rousseau's map, however, is the kind of control they exert. Though different in countless other respects, each of these later maps shares at least one feature in common: an underlying belief that it is okay, even desirable, for music to sound differently from place to place during performance—sometimes radically different, at other times, just differently enough to encourage open dialogue among performers, the audience, and the context of performance. The function of these maps, in any case, is seldom to ensure consistency; neither do they address anything resembling a (universally) "best distribution." Space appears, instead, as a resource that can be used to create interest and variation, rather than hold it in check.

In the second section of this chapter, I will push the study of sound maps even further by exploring what happens when all remnants of traditional notation are abandoned. Where each score discussed so far has found sound maps side-by-side with other, more familiar musical signs and symbols, it is not unusual to find those elements squeezed out, forced "open." What remains—the image of the map and perhaps a few

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[49] Daniel Chua, *Absolute Music and the Construction of Meaning* (Cambridge: Cambridge University Press, 1999).

textual instructions—becomes the defining feature of the score, and in consequence, the principal and sometimes literal object of performance. As I will suggest, these scores represent a tectonic shift in the materiality of music, one whose results specify clearly *where* sound should be made (or encountered) without implicating any particular quality or characteristic of sound itself.

Section II: Maps and Places

The scores I will discuss in this section make prominent use of spatial representation—usually cartography, but also photography and other ad hoc diagrams. In that respect at least, these maps very much resemble the analytical varieties discussed in Chapter 2. Different, however, is the process by which sound comes to be implicated on the surface. On these scores—what I will call "map scores"—specific sounds are not always known or anticipated in advance. Rather, sound is encountered simultaneously with its placement in space—in fact, in some cases, the encounter is the means of placement. This further suggests the primary function of these maps is different: rather than documenting sound (acoustic or psychoacoustic; empirical or remembered), map scores are designed to enframe the physical environment as sonically rich. They identify a location, circumscribe or contextualize it as already sonically charged, then situate a performance there.[50] Often, this is done without predicting which sounds will, must, or should be heard, by whom, how, or when.

In unusual circumstances, a map score can be made through (re)interpretation. Experimental and graphical scores are particularly amenable to this treatment since they

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[50] Certainly this owes some philosophical debt to John Cage's so-called silent work, *4'33"*.

provide ample room for performers to re-imagine what various lines, squiggles, dots, and

dashes mean.[51] In one such instance, performers exploited the structural vagueness of

Cornelius Cardew's *Treatise* to redefine both what and how notation functions. As

Virginia Anderson reports,

> a group of improvising students at De Montfort University placed a copy of one
> page on the floor. This page was then used to indicate areas in the performance
> space in which musical events would happen. As a map, the symbols stood for
> movement and location, and may not have had anything to do with the resulting
> sound.[52]

While the notation was certainly utilized and read in an unusual way, it is by no means

clear, as Anderson suggests, that it no longer has "anything to do with the resulting

sound." What this particular interpretation did was to change the referential object of

notation itself: rather than indicating some aspect of pitch, timbre, or time in the abstract,

it was performed as though it identified a physical spot in real space where sound was to

be produced—whatever the sound, however it is made. Although unorthodox, the

notational marks even during this performance did retain a connection with the resulting

sound.

While indeed unusual, there is precedent for this kind of performative

reinterpretation even in Cardew's published work. Written for a solo performer, the score

for *Memories of You* consists of a single page filled with small vignettes—a series of

small circular diagrams arranged into columns and rows. (Figure 4-9) Each vignette

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[51] Karkoschka, *Notation in New Music*, 77. Karkoschka finds this among music without a pitch/
duration lattice. The performed result "depend[s] on the interpreter's judgement far more than it
does with a work based wholly on an untraditional drawing but having precise instructions at
important points."

[52] Virginia Anderson, "'Well, It's a Vertebrate...': Performer Choice in Cardew's Treatise 1,"
Journal of Musicological Research 25, no. 3/4 (December 2006): 291-317. http://
www.tandfonline.com/doi/abs/10.1080/01411890600840578 (accessed 12 October 2011).

contains a small icon, representing a piano, and a dot, representing sound. While it appears quite similar to John Cage's notational fragment "BT," from the *Concert for Piano and Orchestra*,[53] (Figure 4-10) Cardew's notation is not strictly referential. Cage's notation shows more or less clearly which keys, key areas, or strings on the piano should be utilized during performance—to the point that an ambitious performer could write-out their realization on a traditional clef. By contrast, Cardew's vignettes indicate only the general location around, behind, or near the piano where sound should be produced: in the crook, or at the far end of the sound board.

Aside from lateral position, each dot indicates the general height at which sound is to be produced. Solid dots indicate a "sound made at floor level;" open dots indicate "sounds made above floor level;" and half-solid dots indicate "sounds made both on the floor and above the floor."[54] Instrumentation, meanwhile, is determined by the location of each diagram within one of several rows and columns—labeled A, B, or C. Each letter refers to a particular object, such that "all sounds in a chain headed B are to be made with the object B."[55] Beyond this point, further sonic considerations, like dynamics and duration, are left unspecified. Even time is only loosely notated. Cardew explains that each diagram, in each row or column, is to be performed sequentially, although the specific direction—e.g. from the top down, or left to right—remains for the performer to choose. Any single diagram, however, may be played "once only," meaning shared

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[53] John Cage, *Concert for Piano and Orchestra* (New York: Henmar Press, 1960), 54.

[54] Cornelius Cardew, *Memories of You* (London: Universal Edition, 1967), 2.

[55] Ibid., 2.

diagrams, those at the intersection of columns and rows, are to be skipped after their first use.

The piano, for its part, is left un-played throughout—at least in any conventional sense of "piano playing." While Cardew imagines "[t]he pedal may be engaged throughout the piece," suggesting it might serve as a giant resonator, it would be more accurate to say the piano functions as a fixed object: an idea around which the performer and performance both literally and conceptually circulate. Different from Cage's "BT," then, which seems comparatively focused on keys and strings, depressed or struck in a predictable fashion,[56] *Memories of You* adopts a much broader view of what it means to "play" the piano: it can be played by playing in the space around, above, or below it; it can be played without being touched, using another instrument entirely. In a much more direct way than performative reinterpretation, then, *Memories of You* asserts an unconventional purpose for notation more broadly. While addressing, in a limited capacity, the qualities or types of sound that should be produced in performance—for instance, by identifying an instrument (by letter) or a general sequence of events (by column or line)—its defining characteristic is the way it specifies location and proximity, first and foremost.

Other scores from around this time period utilize notation similarly, although the final effect is sometimes more overtly theatrical. The score for *Titus number 1 for amplified automobile*, composed by American experimentalist Brian Moran, for instance,

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[56] The instructions included at the start of *Concert...* explain: "notes give place of performance with respect to piano." This suggests each dot might indicate a pitch: played on the string or on the keyboard. This is quite a significant difference from *Memories...*, since, except for its resonance, the piano itself remains un-touched.

features a single page filled with ambiguous marks and squiggles, some of which bear a vague resemblance to traditional musical signs. (Figure 4-11) This page is to be copied onto a transparency then projected onto the side of a car. The result indicates "areas of activity"—presumably the marked/squiggled spots, not the blank ones—much in the same way Cardew's *Memories of You* does: by showing the performer which parts of the car to strike, rather than detailing the final sonic outcome.[57] Moran further explains:

> The automobile is amplified in a variety of manners; the performers, using contact mikes, hammers, files, metal scrapers, toilet plungers, etc., move slowly under, through, on top of and around the automobile.
> ...
> After the score has been projected upon the automobile, and the performers have decided upon their individual working areas, the stage should be darkened. The performers use flashlights as they play the automobile.[58]

The resulting spectacle gains further ironic overtones through playing a recording of "Brangane's Warning" from *Tristan and Isolde*, "softly and repeated numerous times," in the background.

Beyond these instructions, numerous practical and logistical concerns remain: how large the projection should be, where it should be aimed on the car, or even more generally, what kind of car to use. Depending on the brand or model chosen, one might imagine quite different sonic results. If hoods and doors rattle and resonate, roofs and windshields are likely to produce a dull thud; an old Chevy made of sheet metal would certainly make different sounds from a modern Mercedes. These same variations apply to the tools of assault: plungers and pipes will both produce distinct sonic effects, while amplification adds another layer of uncertainty—one with so many possible outcomes as

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[57] Brian Moran, "Titus number 1 for amplified automobile," in *Source: Music of the Avant Garde* 2 no. 1 (1968), 80.

[58] Ibid., 80.

to render each performance nearly impossible to anticipate. Like many indeterminate compositions, none of these details are of any concern—or at least, the notation is indifferent towards them. The only aspects of performance addressed with any sort of specificity is *where* sound should be produced, which, in the case of Moran's score, means the literal site of each curve, scratch, or squiggle.

The scores for *Titus...* and *Memories...* might plausibly be considered a form of tablature; but in that case, it would be tablature of a very strange kind. Despite adopting an otherwise "spatial" mode of instruction, most tablature is otherwise quite specific about what sounds should be produced—for instance, by indicating which exact key should be pressed, which frets should be used, and in what order.[59] But in these two works, the notation has no specific regard for the instruments, the performers, or the configuration of an instrumental interface (e.g. keyboard, fretboard, pedal). In that sense, it might be tempting to label these "event scores" or "action score" since, in a fundamental way, they provide directions for doing something—something whose very doing happens to result in the production of sound. But unlike most event scores, these do not say with any particular care what actions should be done. Instead, they behave as maps normally do: they circumscribe a territory, one that can be navigated any number of different ways, allowing for the actualization of a specific goal only the reader knows. Map scores, that is to say, do not mandate that a particular path should be followed, in a specific order, when, or how. While they often depict space with great care—though not without bias—they often leave details of use outside the frame. Likewise, map scores

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[59] Juraj Kojs, "Notating Action-Based Music," in *Leonardo Music Journal* 21 (2011), 66.

present a field of possibilities where action and sound are deeply implicated, but where

the exact outcome is indeterminate: shaped by the aesthetic sensibilities, the environment,

and of course, the physical position of the performer.

City Scale

The idea to enframe space as the site of performance, sound, and audition

becomes especially compelling in the work of composer Stuart Marshall. In the early

1970s, Marshall left Britain to attend Wesleyan University, where he studied composition

with Alvin Lucier. Lucier is, of course, best known for his composition "I am sitting in a

room," which has been variously explained as a demonstration of the contingent

intelligibility of language (and its only incremental difference from music),[60] or as a

performance of raw space, as a slow unfolding of the fundamental pitch of the room

where it is performed.[61] It may not be surprising that similar spatial and sonic

indeterminacies feature prominently in Marshall's compositions. What is surprising,

however, is the kind of notation he used to produce them. Where Lucier's notation very

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[60] This seems to be the reading favored by Lucier himself, who explained that "I am sitting in a room," along with Steve Reich's *Come Out,* "employ repetition to turn everyday speech into music," and "are perhaps closer in spirit to alchemy, whose purpose was to transform base metals into pure gold." See: Alvin Lucier, "Origins of a Form: Acoustical Exploration, Science and Incessancy," *Leonardo Music Journal* 8 (1998): 11.

[61] Golo Fölmer has argued that, "in reality, what we are hearing is only different stages of one and the same phenomenon: the specific resonance of a space ... now the space expresses itself in the reverberation of a sounding object whose own sonic quality is only a coloring addition to the experience of space. The space changes from the surrounding context to the object." See: http://www.medienkunstnetz.de/themes/overview_of_media_art/audio/1/ (accessed 24 August 2011).

often relies on textual maps,[62] Marshall made extensive use of visual representation in the

form of maps and photographs which, at first, seem hardly related to the production of

sound or the performance of music at all. At the same time, Marshall abandons whatever

remnants of conventional notation remained for someone like Cardew or Moran,

including highly stylized allusions.

Several of Marshall's pieces are worthy of mention here, all of which were part of

his composition *Zones*, published in *Source Music of the Avant Garde*.[63] One of them,

titled "Golden Hill," (Figure 4-12) was named after the site in Monmouthshire, Wales

where it was to be performed. In this piece, four auditors stand in place while four ice

cream vans drive winding routes through town. As a van becomes audible, a performer is

instructed to fire a flare gun into the air. And the result, as one can imagine, is not only

sonic ("bang") but visual ("flash")—and at varying distances and points of view, it is

likely to be perceived as visual before becoming sonic. Another piece, "Usk," inverts this

procedure. (Figure 4-13) Here, seven sound producers (presumably radios or speakers)

are scattered throughout the landscape surrounding the town. Auditors, this time mobile,

wander the landscape with the intention of avoiding each stationary sound. Should they

be encountered, however, the performer is instructed to produce some kind of "pulsed

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[62] "I am sitting in a room," for example, is more of an explanatory text than anything else. It explains the process by which the composition is performed, the various steps that have to be taken to perform it, and even what the results demonstrate. Textual instructions seem suitable for this work--while its object is the creative sonic potential of space, the larger message is that space can be reduced, simplified, generalized into a single pitch. This is quite different from Marshall's work, which, though less localized, does not reduce space or the complexity of sound to "fundamentals," but instead utilizes it's complexity as experienced, unmediated, in lived time.

[63] Stuart Marshall, "Zones (1969-1970)," *Source: Music of the Avant Garde* 10 (1972): 5-29.

sound," then move away.[64] A third piece, "Synchronized Door Slam," is in some ways the most structured, although the notation is the least specific. (Figure 4-14) The score depicts an unrecognizable village, possibly in Wales, and calls for any number of performers, in any number of places, to slam doors in a synchronized fashion: maybe all at once, or maybe in sequence—again, the score is not specific about either sonic or temporal details.

In each of these pieces, we are challenged to think about the relationship among notation, sound, performance, and space in an unorthodox way. In "Golden Hill," for instance, the performers produce sound by creating light; in "Usk" sound is not supposed to be heard or enjoyed, but ideally avoided. Just as unorthodox, however, is the appearance of the notation itself. Marshall does not use traditional signs or anything remotely resembling them; an environment or situation, more broadly speaking, is the focus instead. Marshall uses notation to place a sonic experience, to enframe where it is to occur. Meanwhile, the physical position of objects and things is notated quite specifically—although the implications, the performed actuality of the notation, remains highly variable. As heard, a synchronized door slam, performed at the urban scale, might well become a slow "whoosh" rather than a quick "smack," simply by virtue of the speed at which sound travels. The fluidity and unpredictability of weather could also become important. If conditions are windy enough, the performers in "Golden Hill" waiting to

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[64] There is some confusion about the titles and instructions for these two pieces. In the original publication, the text-instructions for "Usk" better fit the map for "Golden Hill," and vice versa. Lucier's description seems only to reaffirm this combination in his article, "On Stuart Marshall." Nonetheless, this looks to me like a publishing error in the original edition; and my description of these works rectifies this puzzling series of misprints by re-matching the each set of instructions with the score that fits most logically.

launch flares may never get to pull the trigger. Unusual, then, is the way that space, and

to a lesser extent, behavior, is shown quite carefully, while the specific sonic outcome is

left for the environment, for the indeterminacies of weather, time, distance, and human

movement to complete.[65]

In some respects, Marshall's music might be said to resemble the installations of

Max Neuhaus. Neuhaus was a classically-trained percussionist who, after encountering

the writings of John Cage, eventually turned his attention to sound sculpture and place-

based sound art. Among his most notable projects are *Sound Figure* (2007), where

speakers projected ambient sounds on a walkway outside the Menil Collection in

Houston, TX, and *Drive In Music* (1967), which positioned loud speakers on a roadway,

so that auditors passing through in a car would encounter a series of sonic fields.[66] These

installations, and others like them, include a visual component, what Neuhaus calls a

"circumscription drawing."[67] As Yehuda Safran colorfully explains, Neuhaus' unique skill

here is his ability to "extract from the incessant flight of sound forms, by means of

memory and intelligence alone, the tentative trembling icons of the sound of human

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[65] Umberto Eco, *The Open Work,* translated by Anna Concogni (Cambridge, MA: Harvard University Press, 1989).

[66] Marshall composed a work much like this. Titled "Doppler," and also part of *Zones,* Marshall's work designates the position of 12 fixed sine wave generators and associated amplification equipment, which were to be mounted ("six feet above the central shoulder of the motorway") on the M5 south of Birmingham, UK.

[67] Neuhaus has himself explained the conditions under which these drawings are made: "After finishing a sound work, if time allows, I wait several months before listening to it again. This is the first time I can stand outside the work and see what it is that I have made. It is only at this point after experiencing the work with distance that I make its circumscription drawing." See: "Drawings," http://www.max-neuhaus.info/drawings/ (accessed 24 August 2011).

sensibility."[68] In more straightforward musical language, these images are what might be called descriptive notation: a translation of something heard or experienced into a relatively stable, fixed, and reflective text. It just so happens that, in this case, the text adopts spatial representation as its medium.

Marshall's notation functions quite differently by comparison. For one, its goal is to help us create new sonic environments and new aural experiences, not to visualize reflexively ones that already exist. More like the notation of Moran or Cardew, Marshall's scores function like maps: they present an environment where a possible experience could be had, but without stipulating too strictly which paths to follow, and without any certainty of which sounds will be made or encountered along the way. In that respect, Marshall certainly owes some conceptual debt to Lucier, but his work also resembles Flux art for its apparent embrace of the ordinariness of the everyday.[69] It challenges the notion that music is (or ought to be) a specialist or professional matter, and instead reframes it as something even untrained people can do. Marshall's notation does not require any special training to read or think about. It can be understood and performed without much technical difficulty, more like an event score by LaMonte Young, George Maciunas, or Alison Knowles.[70] Also striking is the way Marshall's notation leaves in-tact whatever preexisting conceptions about spatial representation we

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[68] Yehuda Safran, "Drawings," in *Max Neuhaus: Sound Works*, vol. II, (Ostfildern-Stuttgart: Cantz, 1994), 7-8.

[69] As far as I can tell, Marshall had no affiliation with Fluxus—although the group's popularity throughout Europe and the northeastern United States throughout the 1960s and 70s suggests some circumstantial associations were possible.

[70] For an excellent analysis of the importance of language to art event scores and the ontology of music, see: Liz Kotz, *Words To Be Looked At: Language in 1960s Art* (Cambridge, MA: The MIT Press, 2007).

bring with us. That is to say, even if all of the performance instructions were erased from the surface, each map and photograph would remain readable.

Indeed, what Marshall composes, and what his scores seem to represent, is the transformation of music from a sonically determined experience to one that is primarily determined by space. And this should underscore a final, unusual feature about his notation: its temporal flatness. To the extent Marshall's scores show when anything should occur—for instance, when an ice cream van will turn a corner, or when a door will be slammed—time itself is only ever implied. The path of each truck appears all at once, simultaneously, while doors remain either invisible or indistinguishable. Without any explicit prescriptions for speed, duration, or the simultaneity of events, this notation can be said to differ even from a score like *Memories of You*, which, at the very least, provides a film-like translation of snapshots. Instead, time in Marshall's work is blurred, condensed into a single frame, more like a time lapse photograph.

(Hyper) Sound Maps

Marshall's notation is unusual for relying so heavily on spatial representation, but it is certainly not the most "extreme" or unusual kind of map score. In other cases, notation moves away from actual cartography and instead resembles (what might be called) a "hyper-map." As Baudrillard explains of hyperreality in general, these maps are defined by preceding what it is they represent—when the map emerges as essentially

fictional, backed by no actual corollary in real space, but is treated as though it mediates a

place already and fully real.[71]

A fascinating example of a hyper-map score can be found in the work of Brazilian

pianist and composer Jocy de Oliveira. Though best-known as a performer of Olivier

Messiaen's piano works, de Oliveira turned her attention during the 1960s and 70s to

composing experimental music with strong political overtones. Along the way, she

proposed a number of spectacular and fantastical visions for how the environment could

be played with, and to maximum creative effect.[72] The score for *Probabilistic Theater I* is

a collage made from different maps, only parts of which are identifiable: the border of

Alabama and Mississippi, the western Mediterranean Sea, the Baltic Sea, parts of Italy

outside of Milan, and a slice of Ankara, Turkey. (Figure 4-15) Despite obvious

differences in scale and geophysical location, each fragment is sutured along thick black

lines, what are explained in the score as "roads."[73] The combined image shows a

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[71] Very early in his essay "The Precession of Simulacra," Baudrillard explains:

> *Today abstraction is no longer that of the map, the double, the mirror, or the concept. Simulation is no longer that of a territory, a referential being, or a substance. It is the generation by models of a real without origin or reality: a hyperreal. The territory no longer precedes the map, nor does it survive it. It is nevertheless the map that precedes the territory—precession of simulacra ..."* (Jean Baudrillard, "The Precession of Simulacra" in *Simulacra and Simulation, translated by Sheila Faria Glaser [Ann Arbor: The University of Michigan Press, 2004], 1.)

[72] In *Polinterações*—which calls not for a performance, but a series of "experiments in perception of sound, situations, sensations, visuality, ethics, time and movements"—de Oliveira proposes the creation of a series of physical environments, a "Main-Space" and a series of "Sub-Spaces." Sub-Space 1 is a human-sized kaleidescope designed to "stimulate the action of other kinesthetic sense organs as well as the visual;" Sub-Space 2 is a blow-up plastic enclosure, which the public inflates to the point of smashing the occupants. (Jocy de Oliveira, "Polinterações," in *Source: Music of the Avant Garde* 4, no. 2 [July 1970]: 66-70.)

[73] Jocy de Oliveira, "Probabilistic Theater I," in *Source: Music of the Avant Garde* 2, no. 2 (1968), 36.

"symbolic town,"[74] one that is to be traveled and traversed during performance. While a

"traffic conductor," dressed to represent "any high rank," coordinates physical movement

from a tall platform, a group of performers—including musicians, actors, and dancers—

move among different areas of the hyper-town, performing, as instructed, along the

way.[75]

Each enclosed section of the map, called a "frame," features a grid with four

squares—some colored white, others orange—each labeled using a number to indicate

the type and kind of performance that should take place there. The instructions are quite

complex and would certainly require time and study to prepare. De Oliveira explains:

> [a] white square represents an empty event, and a yellow one is to be considered
> a full event. They are both directed by the conductor who acts at this moment
> (during frames) as an orchestra conductor. He should use as many frames as
> possible and avoid long durations in each.
>
> The numbers in the square are to be interpreted as event-time, 1 representing a
> short event and 2 a long one. How full and how empty, how long or how short the
> events are, is determined by the conductor. He is to consider a performer only as
> a part of his media in order to build an event in length or action.

The performance, as de Oliveira imagined it, is to take place in "an arena-like theater or a

three-quarter amphitheater,"[76] although the performance record suggests a more modest

setting. (Figure 4-16) Photographic evidence further suggests, unlike the performance of

Cardew's *Treatise* discussed earlier, the map was not itself transposed onto the floor.

Rather than having performers move literally on top of it, the map was projected from a

35mm slide onto a vertical surface, allowing the performers to see and move

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[74] Ibid., 36.

[75] Ibid.

[76] Ibid., 35.

sympathetically with each road. De Oliveira further describes the conditions of

performance:

> The conductor should be located in the center of the stage, high above, but visible to, the performers. His platform should not, however, obstruct the audience's view of the space behind him. It could either be suspended from the ceiling, or it could be supported on an open framework.
>
> Meanwhile, the specific gestures and directions given by the conductor can be developed on an ad hoc basis, although the participants must all understand what each means: make up your own signals to interpret the score-map and be sure the performers clearly understand them. Do not speak during the performance. Act as a god![77]

While De Oliveira herself describes the piece as "an experiment toward an improvisatory

action," it is also much more than that. The resulting hyper-environment, controlled, as it

is, by a hyper-god, is temporary (lasting only for the duration of the piece itself),

localized (constrained by the context and physical limits of the performance), and

immediate (it has to be interpreted and performed simultaneously with its actualization).

A crucial part of the performance is the way in which the "score-map," as de Oliveira

called it, is transferred onto the space of performance. Since it possesses no useful

resemblance to the physical world, the map functions as a kind of spatial Rorschach text:

as an image which asks us to produce an immediate interpretation, one that will loosely

guide the creation of a new space.

Of course, not all of de Oliveira's maps are quite so eccentric. Some, in fact,

return from the realm of the imaginary to rely heavily on otherwise functionally-

referential cartography. Somewhat like the soundwalk maps discussed in Chapter 2, de

Oliveira's work *Treasure Hunt (urban event)* instructs performers to use "their perceptive

senses to explore their environment." After marking a central point on a map, a series of

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[77] Ibid.

concentric circles are drawn, then divided into narrow wedges using "36 converging rays, each of which is separated by 10 degrees." (Figure 4-17) Each corresponding area in real space is then explored systematically: performers are told to travel using various forms of transportation, to document their experience on film or tape, and to bring "anything imaginary" along.[78] The final product of this "urban event" includes not just objects found or sounds recorded, but the intangibles of experience—the memories and observations of the collectors. As de Oliveira explained, the purpose of *Treasure Hunt* is to demonstrate the way in which "the work of art isn't found only inside the theatre, or the museum, but in the streets, on the corners, on the unknown faces of a city, in the life of each one..."[79] The map, then, serves not just as a technical or geospatial guide, but as a kind of constraint, one that funnels and directs the movement and activities of the performers. More like Marshall's maps, it enframes an area, designates it as already rich with sound and experience. It outlines less a "happening" than a "not-yet-happened" in advance.

Connections

De Oliveira's compositions, and to a lesser degree Marshall's and Cardew's, might be said to resemble the work of Guy Debord, a leading member of the Situationist International during the 1950s and 60s. Almost twenty years before *Treasure Hunt*, Debord imagined what he called a dérive—"a technique of transient passage through varied ambiances"—entailing "playful-constructive behavior and awareness of

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[78] Jocy de Oliveira, *Days and Routes Through Maps and Scores* (Ramona, CA: Lingua, 1983), 94.

[79] Ibid., 96.

psychogeographical effects, which completely distinguishes it from the classical notions

of the journey and the stroll."[80] The dérive was developed in response to the much larger

need to explain urban space in new ways, to dig "beneath the paving stones" in order to

uncover how a city's identity is knit together.[81] Arguably for an entire generation of

artists, architects, and musicians, the Situationists demonstrated how "the qualitatively or

quantitatively different influences of diverse urban decors cannot be determined solely on

the basis of the era or architectural style, much less on the basis of housing conditions."[82]

One tool closely associated with the dérive, both conceptually and functionally, is

the psychogeographic map. Unlike more traditional forms of cartography, these maps are

not in any sense linear or rational and share very little in common with space as it is

traditionally understood—as a set of planar coordinates. The goal of psychogeography

was not to aid navigation, but almost the opposite, to reflect a variegated encounter:

"wanderings," Debord wrote, "that express not subordination to randomness but complete

insubordination to habitual influences (influences generally categorized as tourism, that

popular drug as repugnant as sports or buying on credit)."[83] The maps themselves were

collages, made by "more or less arbitrarily transposing maps of two different regions."[84]

Perhaps the most famous example is *The Naked City*, created by Debord in 1957. It is, in

[80] Guy Debord, "Theory of the dérive," in *Theory of the Dérive and other situationist writings on the city,* Libero Andreotti and Xavier Costa, eds. (Barcelona: Museu d'Art Contemporani de Barcelona, 1996), 18.

[81] Guy Debord, et al, *Beneath the Paving Stones: Situationists and the Street, May, 1968,* texts collected by Dark Star (Edinburgh: NK, 2001).

[82] Debord, "Theory of the dérive," 20.

[83] Ibid.

[84] Ibid.

many respects, a reconstituted dismemberment: an incomplete and almost disorienting image, made from a more traditional map of Paris, whose major sites have been disassembled then reconnected using a series of unlabeled red arrows.[85] The myriad flows suggest, but do not explicitly identify, some kind of experiential affinity between each connected area. It is precisely by rearranging the map—sometimes literally marginalizing parts of Paris that might normally be considered central—that a psychogeographic map proposes "a fragmented, subjective, and temporal experience of the city as opposed to the seemingly omnipotent perspective of the planimetric map."[86]

The musical scores I have discussed here might, in some ways, be thought of as instructions for a specifically *sonic* dérive. They enframe a specific environment, call us to wander through it, to perform in it, and listen to it. Sometimes they anticipate what we will hear (like the sound of ice cream vans and radios); at other times, they leave room for us to notice sounds that were unforeseen—or rather, "unforeheard." Simultaneously, there are at least two crucial differences between map scores and psychogeographic maps. The first is how they relate to the event. Psychogeographic maps reference an experience that has already happened: the drift. And while map scores might at times reflect an event that has already occurred, they are more commonly meant to guide those that haven't. The second difference is sound. Where psychogeographic maps reflect unspecified encounters, some of which may or may not be related to sound, map scores

[85] For more on Debord and *The Naked City,* see: Simon Sadler, *The Situationist City* (Cambridge, MA: The MIT Press, 1998).

[86] Alison Sant, "Redefining the Base Map," *Intelligent Agent* 6, no. 2 (2006), http://www.intelligentagent.com/archive/Vol6_No2_interactive_city_sant.htm, accessed 18 November 2011.

like *Treasure Hunt* or *Zones* are accompanied by an explicit assumption that sound is, as it were, always-already audible.

But it would be wrong to say that map scores are meant to be "used" in the same way it would be wrong to say that the *The Naked City* was designed to be read or followed. Many of them are otherwise silent on the question of what should happen and when; and furthermore, in some cases, the maps are not suitable for navigational purposes whatsoever. And yet, the reactions they elicit are likely to be similar. Map scores and psychogeographic maps disorient the viewer *critically*: they ask us to lose ourselves among the ordinary; they connect us to the world, by linking together different (and arguably overlooked) aspects of everyday experience, without saying how; they define a space for exploration, one that can be returned to, re-performed, drifted-through again.

These similarities in turn suggest other strong connections to the world of visual and performance art—specifically, place-based and site-specific environmental art. Certainly Robert Smithson's "Earth Works" should come to mind; but perhaps even more closely connected is the work of Richard Long, a British artist who first came to prominence during the 1970s. Long is well-known for his interest in the non-built environment, and his works often tell the story of a journey or experience using maps and other forms of spatial representation. One well-known example, *On this Hillside*, consists of a photograph, showing an unnamed site in England, and a simple, poetic description of something done there:

> On this hillside I have walked five circles.
> Each circle has been walked around
> for the distance of a quarter mile.

The outermost
and most invisible circle of all
is a quarter of a mile around.[87]

There was no audience here, and there is nothing to be clapped for. Neither is this piece a

dance or a performance that could be transferred to a stage. The site and the performance

are woven together otherwise unremarkably. What matters is action and movement for its

own sake—the unadorned relationship between the performer, a performance, and a

place. The "art," then, is to be found not only in the final product, the representation, but

in the tracing of lived experience that lies beneath.

Other works by Long gesture towards similar ends while making more explicit

use of cartography—sometimes with, and at other times instead of, poetic description.

This allows space to be clearly defined, sometimes at the expense of clarity in action and

movement. *A Walk of Four Hours and Four Circles*, for instance, consists of a map,

showing an area near Dartmoor forest in the southwest of England, with four concentric

circles layered on top. Yet, what was done (or should be done) and experienced (or should

be experienced) remains unclear. Except for the title, important details are left

unanswered, including the direction, order, and speed each circle was walked. Part of

what makes this work significant is Long's view of maps as "public, standardized,

objective documents, [providing] readily available neutral grounds onto which the artist

could chart both his idea and his course in a practical concrete manner."[88] The sense of

objectivity they provide is important, even if problematic, because "[t]o Long, a work of

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[87] Richard Long, *On This Hillside,* gelatin-silver print and pencil on printed paper, 1972, Museum of Modern Art, New York.

[88] Dana Friis-Hansen, *Richard Long: Circles, Cycles, Mud, Stones* (Houston: Contemporary Art Museum, 1996), 17.

art is created first in response to [his own] experience of nature; its resulting relevance to the art world has always been secondary."[89] Maps distill this experience while not asserting their own identity too strongly. They are useful to Long because he views them as a straightforward way to highlight "the structural aspects of the walks."[90]

Long's work might be characterized by its poetics and by the way it situates "the walk" as a fundamental, even formative, medium of aesthetic experience. While his maps share some striking similarities—both visual and conceptual—with map scores, they also have crucial differences. For example, Marshall and de Oliveira by no means view the map as a "neutral" or "objective" medium; for them, maps imply anything but detachment. They function, rather, to implicate the environment as an unstable and specifically sonic field—someplace defined not only by what has already been seen or experienced, but by what can be and, in some cases, can only be experienced there. Where Long's maps locate traces of his own body, map scores typically concern ours; like Cardew's diagrams for *Memories of You,* they designate or define a site for us to act within and move through—and sometimes suggest we do.

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[89] Ibid., 9.

[90] Ibid., 17.

In the end, what map scores do is reterritorialize sound.[91] The incorporation of cartography into musical notation can, in the first place, be thought of as what Deleuze and Guattari have called a "line of flight"—a sudden, if unexpected change, one that should prompt us to reconsider both what musical notation is and the material and sonic relationships it prefigures. In doing so, the map specifically, and notation generally, emerges expanded and enriched, both functionally and conceptually. Space no longer appears in the abstract or in the shadow of sound, but clearly and visibly as a place where sound is already audible, or at least ready to be heard. The map consequently acquires new potential and a new context. It functions both cartographically and as emplaced cartography—as a map that, to be understood, cannot simply be looked at optically but has to be engaged with haptically.

The act of making music consequently becomes a kind of game; and notation, the map, becomes the sometimes literal board on which it is played. While it may or may not constrain the possibilities for physical movement—as Marshall's notation prescribes the

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[91] Deleuze scholar Adrian Parr explains that "[r]ather than understanding deterritorialisation as destabilising that which produces meaning, in *A Thousand Plateaus* Deleuze and Guattari regard it it as a transversal process that defines the creativity of an assemblage: a nonlinear and nonfiliative system of relations." (Adrian Parr, "Deterritorialisation / Reterritorialisation," in *The Deleuze Dictionary,* ed. Adrian Parr [Edinburgh: Edinburgh University Press, 2005], 68) Where deterritorialization "shatters" subjectivity, reterritorialization allows new forms of being to emerge, a process Deleuze and Guattari elsewhere call *becoming.* In one particularly memorable passage, they explain how new forms of being require initially self-differentiation:

> *One reterritorializes, or allows oneself to be reterritorialized, on a minority as a state; but in a becoming, one is deterritorialized. Even blacks, as the Black Panthers said, must become-black. Even women must become-woman. Even Jews must become-Jewish (it certainly takes more than a state). But if this is the case, then becoming-Jewish necessarily affects the non-Jew as much as the Jew. Becoming-woman necessary [sic] affects men as much as women. In a way, the subject in a becoming is always 'man,' but only when he enters a becoming-minoritarian that rends him from his major identity.*
> (Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia,* trans. Brian Massumi [Minneapolis and London: University of Minnesota Press, 1987], 291.)

movement of ice cream vans, and de Oliveira's locates the position of hyper-roads—the

specific outcome, including the sounds that will be heard, remains entirely virtual. Map

scores guide but do not compel us to make sound. Neither do they cajole us to hear it in a

certain way. As musical practice, map scores instead define the parameters of an

encounter, provide a way for us to experiment with(in) it, to move through a space and

notice sound. Crucially, they do this without requiring us to rearrange either our

experience or what we hear into something else—something, perhaps, more

conventionally "musical." What matters most is not any particular "outcome," but

fostering a relationship among the constituent elements of each map: sound, the

performer, the surrounding environment, and so on.

These developments are important because they prompt us to ask an unusual

question about sound in general and music in particular: "Where?" Even from within the

relatively diverse practice of experimental music notation, sound maps help to initiate a

cascading series of tectonic shifts that challenge what we have conventionally and

historically viewed as "essential" characteristics for music, while simultaneously drawing

into question the characteristics we consider "essential" to the study of space and

cartography.

Conclusion

In this chapter, I explored two ways sound maps appear in musical notation. The

first was as work-specific spatial graphics. While seating charts are by no means a

modern invention, these diagrams often have far reaching functional implications. As can

be seen in the compositions of Steve Reich, Iannis Xenakis, Pauline Oliveros, and Henry

Brant, maps are used not only to position people, instruments, and the audience, but to create a performance environment that is dynamic and differentiated: actualizing the diagram without due caution, or drifting beyond the designated envelope, may result in a failed or "unauthorized" performance. Indeed, as well as showing which arrangements should, may, or must be used, maps also prohibit certain configurations, or even force the abandonment of the performance entirely.

Sound maps also appear as "map scores." As discussed in Section II, this notational practice can be defined by its unusual reliance on spatial representation—maps, photographs, and other diagrams—rather than more conventional forms of musical signification. In some cases, the map remains functionally representational, referencing an actual place where a specific activity is to be performed; in others, the image is a hyper-map, showing a location that is, in effect, performed into existence. In both cases, these maps are unusual because they enframe the environment as already audible. From the beginning, they assume space is filled with sound that can be performed in and performed with. At the same time, they often stop short of specifying the qualities, characteristics, or even the exact temporal sequence of performance. Indeed, while the aural aspects are, to a great degree, left "open" in these works—left for environmental and human indeterminacies to complete—they make clear spatial provisions by indicating *where* sound is to be heard, produced, or encountered.

Chapter 5: Sound Mapping the Utopian City

> Acoustic design is not merely a matter for acoustic engineers. It is a task requiring the energies of many people ... Artists, who have too long remained aloof from society, must now return to give direction to human navigation.
> —R. Murray Schafer, *The Vancouver Soundscape*

Introduction

Where do sound maps lead us? As I have explored in previous chapters, sound maps are not just analytical tools: they have opened new experimental avenues in creative and artistic practice. From the staging diagrams of Iannis Xenakis to the cartography of Jocy de Oliveira; from the prescriptions of Steve Reich to the prohibitions of Henry Brant, sound maps, used as a form of graphical notation, change how and on what terms we relate to the performance of music—both the bodily act of making sound and the physical site of its production. In some extreme cases, like *Memories of You* by Cornelius Cardew, space becomes the priority. A particular quality of sound, or the particular sequence and simultaneity of sounds, matters less than the location where sound is to be made or encountered: above the piano, or a village in Wales. By reshuffling both material and sonic priorities, sound maps challenge recursively the boundaries of musical notation as they are traditionally understood. And in consequence, they empower us to make music cooperatively *with*, rather than opportunistically *in*, the surrounding environment.

But none of the sound maps I have analyzed address the most forbidding theoretical and practical challenge of sound-space interactivity: the configuration of the open air, the audible design of the city itself. Indeed, over the last twenty to thirty years, as soundscape and sound studies scholars have called our attention to the formative role sound plays in everyday life, they have also started to theorize as to how sound can

become an agent of change and be utilized to improve our quality of life. In his book

Acoustic Communication, for instance, Barry Truax explains how acoustic design is

imperative in order to "create a balance between variety and coherence at the level of

information exchange, and to create a functional equilibrium at the level of relationships

within the community."[1] Implementing a better, more thoughtfully considered

soundscape would thus require both restructuring sound "to make it more informative and

patterned,"[2] and further modifying "relationships within the system, particularly those

that have degenerated."[3] In *The Vancouver Soundscape,* R. Murray Schafer likewise

equated the city with "[a] huge musical composition ... unfolding around us ceaselessly.

We are simultaneously its audience, its performers and its composers."[4] He furthermore

argued the city's aural design should not be left simply to engineers. "It is a task," he

wrote, "requiring the energies of many people: professionals, amateurs, young people—

anyone with good ears."[5]

While early efforts to compose (or rather, re-compose) the acoustic environment

would require both close listening and systematic documentation—issues addressed

earlier in Chapter 2 of this dissertation—it stands to reason that later stages would require

implementing an intentional, thoughtful design. Yet Schafer, like Truax, provides little in

the way of concrete details. He highlights the necessity of supporting noise abatement

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[1] Barry Truax, *Acoustic Communication,* 2nd ed. (Westport, CT and London: Ablex Publishing, 2001), 114.

[2] Ibid.

[3] Ibid.

[4] R. Murray Schafer, ed., *The Vancouver Soundscape* (Vancouver: A.R.C. Publications, 1978), 64.

[5] Ibid.

organizations, and furthermore admits "we do not yet have enough facts to undertake the

comprehensive acoustic design of the communities of the future," but the closest he

comes to offering specific advice is by proposing:

> ...the erection of temples of silence ... temples where one could read or meditate
> ... We can also begin speculatively to prepare plans for acoustic parks, which
> would afford both reservoirs of stillness and areas where the ear and mind could
> be delighted in new and imaginative ways.[6]

It is surprising, if not paradoxical, that a soundscape scholar would suggest we escape

from sound rather than seek out and embrace its creative indeterminacy. Moreover, the

design solutions he recommends are nothing if not disappointing. "Acoustic parks,"

though clearly demonstrations of design, are diametrically opposed to fostering a deeper

understanding of the urban ambience; likewise, if they are not already inconsequential,

"temples of silence" would seem to provide an easy escape from the sounds of everyday

life, possibly even a way to avoid them altogether. But Schafer is not alone in his

escapism. Indeed, while arguing passionately for more harmonious cities, most plans to

"design" sound at the urban scale resort similarly to discussions of noise mitigation,

including the erection of highway barriers,[7] the imposition of noise fees,[8] or more

generally, the need "for timely research into what is positive about the soundscape and

how such knowledge can be effectively incorporated into policy."[9] Equivocation,

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[6] Ibid., 66.

[7] Urban Systems Research and Engineering, *The Audible Landscape: A Manual for Highway Noise and Land Use,* report prepared for U.S. Department of Transportation, Federal Highway Administration, Office of Research and Development (November 1974, reprinted August 1976).

[8] Committee on Appraisal of Societal Consequences of Transportation Noise Abatement, *Noise Abatement: Policy Alternatives for Transportation* (Washington DC: National Academy of Sciences, 1977).

[9] Mags Adams, et al, "Sustainable Soundscapes: Noise Policy and Urban Experience," *Urban Studies* 43, no. 13 (December 2006): 2396.

meanwhile, leaves unanswered important questions about how such a city would function

sonically, philosophically, and technically—what it would sound like, and how the

unstable aural textures of everyday life might be turned back on themselves.

The final chapter of this dissertation seeks to remedy these gaps and answer these

questions, however provisionally, by exploring one area of research sound maps point

toward: plans for the urban environment that make a concerted effort to anticipate the

function and ideal role of sound in everyday life. In particular, I will examine the 1969

book *La Ville Cybernétique,* a kind of literary-utopian sound map written by Hungarian-

born French sculptor Nicolas Schöffer. Not only does this text theorize the contemporary

biopolitical subject, it provides a detailed explanation of how urban sound might be

deployed cooperatively and creatively: re-composed, in real time, to create a pleasing

sense place. Though Schöffer's work is occasionally mentioned in scholarly literature, it

most usually appears in surveys on sculpture or cybernetics.[10] To date, there has been no

serious analysis of Schöffer's work on sound, nothing to cast in a critical light his plans to

use the city as a site and source of musical invention (and intervention).

Consequently, this chapter will have two discrete goals. The first is to perform a

close, sound-focused reading of *La Ville Cybernétique.* In Section I below, I will discuss

the root social problems Schöffer observed in society and analyze how and why he

believed sound could, once creatively and thoughtfully utilized, help to solve them. The

second goal is to build a critical context around Schöffer's work. After examining why

the Cybernetic City was greeted with skepticism, I will discuss how Schöffer's embrace

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[10] For instance, see: Julia M. Busch, *A Decade of Sculpture: the 1960s* (Philadelphia: The Art Alliance Press, 1974), 125-131.

of participatory sound- and music-making, though mediated by machines, resembles what

Jacques Attali saw optimistically as the future of music: "composing." In the end, this

chapter will speak to some ideal (and idealizing) practices that draw upon the sound map

as a way of thinking about and engaging with the everyday environment.

Section I: Sensing Trouble

In 1961, a large tower was erected outside of the Palais de Congres, near Boverie

park in Liège, Belgium. Measuring some 52 meters in height, the scaffold-like structure

stood in stark contrast to the sleek surface of the nearby façade of the Palais. But the

tower was not just a static object; it was part of an artistic and technological spectacle: the

literal focal point for a dynamic multimedia show, one that shifted in response to

environmental fluctuations. Suspended from the tower's skeleton was a series of small

arms, suspending 66 mirrors and 120 multicolor light projectors. (Fig. 5- 3.) At nightfall,

a bank of high-powered lamps would be switched on and aimed at the tower, dousing it in

light and reflecting a chromodynamic spectacle onto the Palais. But there was more to the

tower than could be *seen*. It was also connected to a computer system, which processed

the collected data using "microphones for sound, photoelectric cells for light,

thermometers, hygrometers, [and] anemometers." This information was later used to

initiate an "ever-varied combination and numbers of movements, according to instruction

given to the brain."[11]

Called *Chronos 3*, Schöffer would explain in great detail how towers like this one

could be used to remake the city. Far from museum pieces or works of public art, they

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[11] Ibid., 107-08.

could become tools capable of creating a more pleasing city, observing and responding to shifts in the urban ambience.[12] In doing this, he believed, they could also help rectify some of our most vexing cultural ills—problems related both to over-consumption and a slackening in aesthetic sensibilities.

Médiocrisation

To begin with, Schöffer was unhappy with what cities had become. Like many of his contemporaries, including Yona Friedman and Constant Nieuwenhuys, Schöffer disliked how, following the Second World War, "the urban" had become increasingly synonymous with generic, large, confusing, and filled with cars.[13] But rather than giving up—writing-off cities as places to be avoided or feared—he viewed them as places of promise, even creative potential. Schöffer outlined his vision for what the city could be in *La Ville Cybernétique*.[14] The timing of its publication is worth noting: Schöffer's optimistic, even exuberant, effort to re-imagine the very texture of everyday life appeared at a time of tremendous social and political discontent. Aside from international upheavals caused by decolonization and persistent Cold War tensions, the world found itself more broadly engrossed by social uprisings, clearly articulated in the riots of Chicago throughout 1968 and the student uprising in Paris during May of that year. Little

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[12] Marcel Joray, ed., *Nicolas Schöffer*, introduction by Jean Cassou, with articles by Guy Habasque and Jacques Ménétrier, translated by Hakkon Chevalier (Neuchâtel, Switzerland: Éditions du Griffon, 1963), 148.

[13] Larry Busbea, *Topologies: The Urban Utopia in France, 1960-70* (London and Cambridge, MA: The MIT Press, 2007).

[14] Nicolas Schöffer, *La Ville Cybernétique* (Paris: Tchou, 1969), 135.

surprise, then, that Schöffer chose to begin his book by stepping back from "real world"

problems to dwell on where and why modern life had gone so terribly wrong.[15]

Central to his diagnosis was *médiocrisation*, which, he writes, can be understood

first as "ignorance, the lack of information." While it is incumbent upon all people to be

observant—for instance, in order to "establish a sense of direction, to acquire

information, to remember it, and actualize its possibilities"— *médiocrisation* is the

inevitable result of having too little information, or an abundance of low-quality sensory

information.[16] As Schöffer explains, however, *médiocrisation* is not meant in a pejorative

sense to condemn any particular person or group of people. Rather, he hoped it would

challenge the current emphasis on consumption by framing it in historical terms. But he

also went a step further, suggesting that cultural and political elites are the executors and

beneficiaries of *médiocrisation*, rather than more simply its exemplars.

Far from signifying health or prosperity, Schöffer argues our desire for

specifically quantitative expressions of wealth, and moreover, our material capacity to

actually provide that wealth, indicates an ominous socio-structural trend. Echoing Marx,

he explains *médiocrisation* conceals a play of power, one presaged centuries ago:

> The cultural elite of the Medieval rather easily obtained the support of the ruling
> class. Their artistic policy, first practiced for religious reasons, made extremely
> intelligent use of art. The Mass was the first audiovisual show [in] the Western world,

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[15] It is worth noting here that Schöffer's critiques of modern life share much in common with what Max Horkheimer and Theodor Adorno observe in *Dialectic of Enlightenment*. A full analysis of the similarities and tensions between them, however, will have to be left for another time.

[16] Schöffer, *La Ville Cybernétique*, 15.

> *Le terme de médiocrisation ne doit pas être pris dans un sens péjoratif, mais envisagé sous l'angle de l'évolution et de l'Histoire. La médiocrisation, c'est l'anomie, le manque d'information. Chaque individu étant pourvu de sens qui lui permettent de percevoir les phénomènes ambiants, d'enregistrer des informations, de les mémoriser, d'exercer son combinatoire. La médiocrité résulte d'un niveau d'information extrêmement bas.*

a beautifully structured program, the perfect synthesis of all the basic elements of a total work of art: sound, light, space, ballet, mime, symbolic play. This setting provided for the use of religious ideas—as spiritual and political phenomenon—to facilitate greater control over *médiocrisés*.[17]

While *médiocrisation* today still hides political and cultural maneuvering, the site of the spectacle has changed. Rather than church, it can be found on television—which, by Schöffer's reckoning, consists of worthwhile content no more than 0.3% of the time.[18]

But it is not just television that promotes *médiocrisation*. Contemporary architecture and design do likewise, as do technological and scientific research more broadly.[19] The latter may be particularly surprising, though, since science of all areas of inquiry claims to dispel ignorance—for instance, by encouraging the establishment of basic, empirical

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[17] Ibid., 16.

L'élite culturelle médiévale a obtenu assez aisément le soutien de la classe régnante. Sa politique artistique, pratiquée d'abord pour des motifs religieux, utilisa les ressources de l'art avec une extrême intelligence. La messe fut le premier spectacle audio-visuel du monde occidental, admirablement structuré, programmé, synthèse parfaite de tous les éléments de base d'une oeuvre d'art totale: son, lumière, espace, ballet, mime, jeu symbolique. Cette mise en condition servait l'idée de religion—phénomène spirituel et politique—et facilitait la mainmise sur les médiocrisés.

It is not clear what Schöffer means by "ballet" and "mime" here, since I can find no evidence that either were used in church during the Medieval period. While it is possible that Schöffer is using the word "mime" in a very broad sense, for instance, to reference ritual gestures like blessings, it is not clear how Schöffer believed dance was used. It may be a similarly broad use of the word, perhaps to reference kneeling, the kissing of papal rings, etc—but this much is purely speculation.

[18] Ibid.,18.

Il ne trouvera pas plus de 0.3% d'informations ayant une valeur quelconque sur le plan culturel ou historique.

[19] Ibid., 24.

La fabrication de ces faux produits est massive. On crée des besoins artificiels, stéréotypés. 90% des Français rêvent d'avoir un intérieur "de style." C'est là le côte inquiétant du problème. Jamais le passé n'incitera les individus à penser l'avenir, c'est-à-dire à bouleverser l'état actuel des choses. Installés confortablement dans un environnement qui leur rappelle tout ce qui a été fait auparavant, ils ne pourront pas avoir de préoccupations prospectives. Le passé est un frein providentiel pour les manipulateurs et pour le système répressif actuel. C'est également une des causes de la collusion entre cette production du passé et les intérêts commerciaux de certains.

truths. But it is here that Schöffer's alternate definition becomes important.

Médiocrisation is defined not just as a lack of good information, but also as an abundance

of poor quality information—what might be called social, cultural, or sensory "noise."

From the perspective of sound studies, the latter definition of *médiocrisation* very

closely resembles what R. Murray Schafer has called "lo-fi" listening environments.

These are not places that are especially sound-poor, but rather environments so

overwhelmed by large quantities of sound that very little sense or meaning can be

gleaned from them. Schafer explains:

> In a lo-fi soundscape individual acoustic signals are obscured in an overdense
> population of sound ... In the ultimate lo-fi soundscape the signal to noise ratio is 1 to
> 1 and it is no longer possible to know what, if anything, is to be listened to. The lo-fi
> soundscape results when accidental, trivial or boring sounds are allowed to
> proliferate unchecked.[20]

Where lo-fi environments can be understood as victims of specifically sonic forms of

excess—too many cars, too many airplanes, too many things that make sound—Schöffer

likewise explains that *médiocrisation* more generally demonstrates our cultural desire for

"always more." Quantity, in this analysis, precedes *médiocrisation* and is in fact

principally responsible for it.

The suggestion that science and technology contribute to *médiocrisation*,

intellectual "noise," therefore has crucial implications. Principally important is the way

they were seen to replace religion as the primary purveyors of mythic truths. According

to Schöffer, people were beginning to view scientific and technological advancements

with a level of apathy similar to that with which they regard opaque religious rituals—

namely as things "beyond" or "outside" human understanding. In being both complex

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[20] Schafer, *The Vancouver Soundscape,* 48.

and intangible, the developments of science and technology were reinforcing public

bewilderment; in becoming the focus of our wonder and amazement—rather than a

vehicle for our enlightenment—they frustrate as much as motivate our curiosity.[21] Indeed,

much as the spectacle of the mass facilitated the condensation of power into the hands of

a select few, Schöffer worried that something similar was happening in the 20th century.

While manufacturing and mass production have allowed ordinary people to use

technologically advanced consumer goods on a daily basis, the broader effect, Schöffer

believed, was to discourage general cultural and scientific literacy. That is to say, in

becoming so comfortable with sophisticated machinery, and moreover, familiar with the

general existence of ontologically-difficult theories,[22] people today believe science is

either too complicated to understand or unnecessary to understand: simultaneously simple

and unapproachable. One unfortunate result is that promising new technologies—

especially those like *Chronos 3*, which Schöffer believed could effect real cultural change

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[21] Schöffer, *La Ville Cybernétique*, 19.

> *Mais l'homme de science n'a pas été seulement utilisé, il est devenu complice de cette féodalité nouvelle, la science jouant un peu le même rôle que la religion dans le passé.*

[22] Slavoj Žižek, *The Reality of the Virtual*, directed by Ben Wright, Olive Films, 2007. Žižek argues quantum mechanics exemplifies what Lacan called the symbolic-virtual:

> *it's simply for example scientific discourse, scientific formulas ... that which resists symbolization, inclusion into our universe of meaning. And isn't it that which precisely happens when, for example, in quantum physics? What is quantum physics? Formulas which work ... but we cannot translate them into our daily experience ... we literally cannot understand it. Not in the sense that we—common people, idiots—cannot understand it, only a couple of scientists can; even they cannot. In what sense? In the sense that 'it just works;' but if you try to build a consistent ontology out of it, again, you get meaningless results. You get time running backwards, you get parallel universes ... you get things which simply are meaningless with regard to our ordinary notion of reality.*

—go largely ignored, assumed by ordinary people to be "unnecessary and inappropriate for their level of understanding."[23]

It is worth noting, however, that Schöffer did not find material consumption itself problematic—at least not in a strict Marxist-materialist sense. For instance, he seems generally unbothered by issues of labor exploitation or the depletion of natural resources. His concern, rather, was that our interest in, and emphasis on, specifically quantitative expressions of wealth—not money *per se,* but "things" more generally—has resulted in a gross reduction in our quality of life: a proliferating sense of indifference, and a corresponding inability to interact meaningfully with the world and each other. Quantitative abundance had produced, in other words, a peculiar and paradoxical form of poverty, one expressed simultaneously by overfamiliarity and under-education, overstimulation and underutilization, shallow pleasure and harmful perturbations. The result was a disturbed people, a privileged elite, and a society at risk of collapse.

Sensing Change

To effect change would require interrupting or, better still, reversing *médiocrisation.* This promised to be difficult, as Schöffer explained, because *médiocrisation* had been woven into the very fabric of daily life. Unraveling it would therefore take place in stages. In the first, the material conditions of the city would have

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[23] Schöffer, *La Ville Cybernétique,* 19.

> *Scientifiques et technocrates, s'engageant dans une série de compromis, orientant leurs recherches dans le sens d'une production massive de produits, ont soigneusement évité de toucher aux véritables problèmes culturels ... tout en profitant d'une façon évidente mais superficielle des produits de ce secteur, elles ne souhaitent pas être approvisionnées en produits culturels dont la compréhension et la jouissance leur échappent, considérant tout naturellement ces produits comme superflus et inadaptés à leur niveau d'information.*

to be reinvented: all traces of *médiocrisation* would need to be erased from the map. In the second, the social preference for abundance would have to be challenged directly, replaced by an appreciation of quality and clarity.

Emphasizing quality, however, should not be taken to mean Schöffer somehow sought deprivation or asceticism—although his plan, as he explained, would require people to "surrender some comfort, especially intellectual comfort."[24] Specifically, it would ask people to think differently, if not for the very first time, about social, architectural, and environmental relationships, the vast majority of which go unnoticed. This new way of living would require people to question the nature of work and leisure, and moreover, to rethink the material structure of daily life by becoming more cognizant of its experiential texture. But it would also require people to devise new ways to fill the gaps of experience—to engage creatively with this texture. Schöffer's ideal was not a smooth, unchanging, or stable state, though. To some extent, he believed psychological "perturbations" were "inevitable for the diversification and development of life"—though for the most part, unplanned and un-contained perturbations tend to be harmful.[25] Technology, therefore, has an important role to play: it can both mediate and ameliorate disruptions and social tensions as they occur, transforming them into a productive, welcome, artful intrusion. Rather than being the cause of social and political unrest, the city's technological infrastructure, once buttressed by a carefully designed program,

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[24] Ibid.,11.

[25] Ibid: "Si les perturbations sont inévitables pour la diversification et le développement de la vie, les effets traumatisants sont souvent nocifs."

could target specific aspects of the urban environment for creative intervention. Art could

thus participate:

> ...directly in this newly-evolved society by offering the extraordinary conceptual and imaginative freedom that has always allowed it to escape all constraints and exceed all the other achievements of human activity.[26]

While Schöffer clearly understood the dangers of technology—at least in terms of

médiocrisation—he seems not to have believed those dangers were inherent. Like other

technophilic theorists of the period, Schöffer believed technology had the potential to

liberate people from the oppressive conditions of daily life, functioning as an extension of

human consciousness. This sentiment mirrors what Félix Guattari would later write:

> [T]he fact that machines are capable of articulating statements and registering states of fact in as little as a nanosecond ... does not make them diabolical powers that threaten to dominate human beings. [Machines] are nothing other than hyperdeveloped and hyperconcentrated forms of certain aspects of human subjectivity, and emphatically not those aspects that polarize people in relations of domination of power.[27]

Much like Guattari, Schöffer viewed technology as a vehicle, one granting us the power

and ability to do things we might otherwise not be able to—including the power to

manipulate intangible parts of fractional space that would otherwise be difficult or

impossible to access. While technology undoubtedly has the potential to change how and

on what terms we relate to the world, when carefully utilized, it can also "serve us and

lead us forward."[28] Technology emerges here as a kind of conceptual map, capable of

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[26] Ibid., 12; "...directement à cette nouvelle forme d'évolution en offrant l' extraordinaire liberté conceptuelle et imaginative qui lui a toujours permis d'échapper à toutes les contraintes et d'accéder à des dépassements qu'aucune autre activité humaine n'a pu atteindre."

[27] Félix Guattari, "Regimes, Pathways, Subjects," translated by Brian Massumi, *Incorporations,* eds. Jonathan Crary and Sanford Kwinter (New York: Zone, 1992): 16-19.

[28] Schöffer, *La Ville Cybernétique,* 64.

guiding us down a path toward a more meaningful and creative engagement with everyday life. Cities, in becoming cyber-technic installations, would reemerge as the site of collective artistic engagement: places where harmful disruptions are actively expelled, replaced in real-time by artfully planned, computer-facilitated sensory environments.

The Role of Art and Design

Re-imagining the city, and subsequently remaking the very fabric of everyday life, would require first the redemption of art itself. And because many contemporary artists had already established opportunistic alliances with the materials and methods of mass production, Schöffer believed they had been corrupted irreversibly. Worse still: artists had capitulated to the desire for cultural legibility. In Schöffer's view, there was simply too much art in the world, too much of which had been made specifically to appeal to the masses. Beneath this apparent corruption, he believed the wealthy elites, especially Americans, stood to benefit. He explained:

> Gradually, thanks to so-called experts, manipulators of history and art history, and through a prose as abundant as hollow and dangerous ... [artists] began to produce ... "pop" art and false surrealism, whose illustrious representative (whose name is easy to guess) is Salvador Dalí. His work is the archetype of pure unabashed artistic alienation; it favors the annihilation of creative ferment and disturbance in the human imagination. All of this is the work of an unusually powerful social group which has achieved the highest peak of the oppressive organization and manipulation of the masses: wealthy society in the U.S.[29]

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[29] Ibid., 14.

> *Peu à peu, grâce à certains prétendus spécialistes, manipulateurs de l'histoire et de l'histoire de l'art, et par l'intermédiaire d'une prose aussi abondante que creuse et dangereuse ... ils commencèrent à fabriquer du faux dada ou post-dada, c'est-a-dire du "pop" art et du faux surréalisme dont l'illustrissime représentant (c'est facile à deviner) est Salvador Dali, pur prototype du système d'aliénation éhontée de l'art au profit de l'annihilation des ferments créatifs et perturbateurs de l'imagination humaine. Tout cela est l'oeuvre d'un groupe social exceptionnellement puissant qui a réussi à atteindre le plus haut sommet de l'organisation oppressive et de la manipulation des masses: la société des possédants aux U.S.A.*

By encouraging cheap art—and indeed, art that was conceptually impoverished—today's

elites have initiated a transfer of power, one that has solidified the existing social

hierarchy and further spread *médiocrisation*. The remedy was not simply to banish

accumulation, or to force artists like Dalí to stop their work. This, by Schöffer's logic,

would only amplify the effects of *médiocrisation* in the near term—further hastening the

transfer of power. The solution, instead, was more radical: it was to undermine both

médiocrisation and the subsumption of power simultaneously by challenging the very

aesthetic and social paradigm that made quantitative accumulation desirable in the first

place. In theory, this would require analyzing the structure and materiality of daily life; in

practice, it would require us to access and make use of what Schöffer called "fractional

space."[30]

Schöffer believed the ultimate challenge of design was not the question of where

to put walls. Buildings, he thought, should be flexible, modifiable, even moveable—and

to that end, he gives special praise to Eero Saarinen's design for the "mobile lounges" at

Dulles airport in Washington.[31] It is perhaps not surprising, then, that Schöffer believed

space should be defined not exclusively by its fixed or material properties, but in a more

complex fashion, by the sensory textures between the proverbial walls. Despite any

apparent "emptiness," he viewed space as richly dense, filled with "phenomena of

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[30] Ibid., 72.

> ...il s'agit de supprimer totalement le modelage des matériaux solides et de les utiliser exclusivement pour la captation de fractions d'espace définies pour rythmer ces programmes.

[31] Schöffer, *La Ville Cybernétique*, 134.

powerful energy."[32] The ultimate conceptual and practical challenge, then, was to control these phenomena, thereby giving discrete sensory form to the city, and new shape and meaning to everyday life.[33]

Turning our attention to the design of fractional space, Schöffer says, would require a new design philosophy, a new conceptual approach, one where the design of physical materials is given "some importance," but where the intangibles, "the space included in the structures," become the principal focus.[34] Design would therefore mean learning to control and manipulate "fractional space" to achieve maximum effectivity— creating a pleasing environment that challenges and enlightens us, that would be conducive to constructive activity rooted in work or leisure. Like "fractional" phenomena themselves, which would change, flow, and dissipate over time, no singular configuration of the city would be "ideal:" by nature, it would have to be dynamic, able to change and adapt to feedback provided both purposefully (by the city's residents) and automatically (by environmental readings collected by sensors).

It is worth reemphasizing here that the goal of the Cybernetic City was not to stabilize all moment-to-moment fluctuations. It was rather to redeploy them creatively and productively—an idea Schöffer qualifies at some length:

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[32] Ibid.,118.

> En effet, le plus petit fragment de l'espace contient des phénomènes énergétiques puissants.

[33] Ibid., 72.

[34] Ibid.

> ... être construite avec rigueur; elle doit être à la fois légère, monumentale et stable. Sa structure doit obéir à certaines règles. L'objet a de l'importance, mais c'est le côté immatériel, en l'occurrence l'espace inclus dans les structures, qui détermine l'importance de l'œuvre ...

> Indeed, every day we find that "it changes;" but it is important that these changes occur without shock, that they are to some extent amortized by the beneficial presence of art. Art is able to address both aesthetic concerns and the needs of society, and its interventions offer solutions posing no danger. On the contrary, they humanize all of the elements of developing progress; and it is this progress that leads us, every day with increasing haste, to distant and unknown worlds.[35]

In the end, if *médiocrisation* was responsible for producing and reproducing social, political, aesthetic, and wealth inequality, the challenge of the Cybernetic City was to do the opposite: to generate, in part through technological processes, an equitable society, one where emphasis is placed on the quality (rather than quantity) of life.

Schöffer thus maps his way out of contemporary problems through negation, but in doing so, finds himself chasing awkwardly incompatible goals: to actively prevent disruptions while utilizing indeterminate creative methods; to embrace change while avoiding cheapness; to design space by embracing what seems implausible to construct; to appreciate the artistic potential of fractional space while preempting the emergence of yet another false consciousness. His solution to each of these problems—technology— would require a complex network of sophisticated computers. The resulting cybernetic ecosystem, once connected to environmental sensors, input control consoles, and an array of (often unspecified) "active" intervention technologies, would be able to produce specific and context-appropriate sensory interventions in real time.

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[35] Ibid., 136.

> *Nous constatons en effet, chaque jour, que "cela change," mais il importe que ces changements surviennent sans secousse, qu'ils soient amortis en quelque sorte par la présence éminemment bénéfique de l'art. Celui-ci axé sur des préoccupations à la fois esthétiques et sociales impose, en intervenant, des solutions qui ne comportent aucun danger, mais au contraire humanisent tous les éléments du progrès en formation, ce progrès en formation, ce progrès qui nous entraîne chaque jour plus rapidement vers des mondes lointains et inconnus.*

Despite any techno-totalitarian overtones, however, the goal of Schöffer's plan was to create a responsive, indeed, participatory city, one where residents could themselves register any change in mood or sentiment by turning a dial or pressing a button. This information would then be sent to a central cybernetic brain, "where it would be quantified constantly and transformed into flexible orders, reacting immediately to the events in question."[36] Indeed, as will be explained in further detail below, while Schöffer does not always specify what these reactions would be or how they would be implemented, the goal nonetheless was to use technology to open the black box of fractional space, to provide ordinary people some say in how the sensory experience of the city is composed, as Schafer explains in the epigraph to this chapter.

Composition

To organize this new cybernetic environment, Schöffer proposed dividing fractional space into five constituent parts, what he called *topologies*: time, light, weather, smell, and sound. "Time," the first topology, is closely related to what other theorists, including Henri Lefebvre, have called "rhythm."[37] The Cybernetic City would have

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[36] Ibid., 109-10.

> *Chaque fois qu'un habitant désire un changement quelconque dans un domaine donné, dans le sens de la diminution ou de l'augmentation, il tourne jusqu'au degré souhaité et appuie sur le bouton correspondant aux phénomènes choisis. Les informations ainsi recueillies sont reçues par le cerveau central où elles sont constamment quantifiées et transformées en ordres souples réagissant immédiatement sur les événements en question.*

[37] Henri Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life*, trans. Stuart Elden and Gerald Moore (New York and London: Continuum, 2004).

"zones with varying density," arranged so that "a set of rhythms ... will fit together,

forming a structure or a sculpture of time, or more accurately, temporal variation."[38]

Planning a city, Schöffer believed, meant anticipating how and where different activities

unfold, how frequently they recur, and mechanisms capable of encouraging a pleasing

indeterminacy of sound. In that way, the city's design would prefigure a series of

unplanned encounters, some of which are more likely to occur than others, and, like a

work of chance-based art or music, none of which strictly prescribe the order, sequence,

or necessary outcome.

Specifics beyond this are scarce; but it is at least clear from Schöffer's drawings

that the city would be divided into different use-zones—zones for sleeping, zones for

working, among others. These zones would, in turn, contain buildings designed

specifically to suit the activities that would take place inside of them. For instance,

Schöffer estimates that two-thirds of our lives are spent either in a state of recreation or in

a state of sleep, and this would have a necessary effect on the city's physical design.

Leisure activities, sleep especially, would necessarily take place in buildings oriented

horizontally: "skyscrapers cannot be a place of sleep," he wrote, "because they do not

promote peaceful and inactive dreams."[39] Living quarters consequently were to be in

buildings both low and long, slightly elevated on pylons to allow for ample green space

below. (Fig. 5-1) Each individual living module would be fully adaptable—able to be

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[38] Schöffer, *La Ville Cybernétique,* 111.

[39] Peter Weibel, *Beyond Art: A Third Culture* (New York: Springer, 2005), 316-17; Wiebel here quotes and translates Schöffer: "the visual impression of verticality incites us to rise so that we find ourselves in a position parallel to our surroundings. The horizontal stimulates relaxation and de-concentration."

changed to suit the physical, mental, and environmental needs of each resident. It would

also be completely isolated by "impermeable walls," and therefore protected from noise,

unwanted climatic change, or other social disturbances.[40]

And yet, for a plan that seems to idealize the purposeful manipulation of fractional

space, there is a surprising embrace of indeterminate change evident in Schöffer's

writing. This becomes especially clear in the way Schöffer theorizes another important

topology. Light, he says, should not be taken for granted as inevitable, neither should it

be understood as an immutable part of daily life. It is, he explains, a plastic medium like

any other, one whose full potential has yet to be effectively implemented at the urban

scale. The right kind of light, beamed at the right place and moment, can "activate or shut

down life in the city, or a specific part of it, should the need arise."[41] The central

cybernetic regulation system would again have an important role to play. It would

become possible:

> ...to capture natural light and to introduce it temporarily or permanently into
> shadowed areas—to create points of intense radiance, or conversely, daytime
> shadows, as they are needed and pleasing. The artificial coloration of bright areas
> during daytime.[42]

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[40] Schöffer, *La Ville Cybernétique*, 107.

> *Sur le plan individuel, l'occupant se sentira à l'aise dans sa cellule, n'ayant pas de vis-à-vis, ses voisins latéraux étant isolés par des parois étanches. Les cellules sont extensibles latéralement et en hauteur, aptes par conséquent à recevoir des familles en nombres variés.*

[41] Weibel, *Beyond Art*, 317.

[42] Schöffer, *La Ville Cybernétique*, 113.

> *...la captation de la lumière naturelle et son introduction temporaire ou définitive dans les zones d'ombre. La création de points de rayonnement intense ou, au contraire, de zones d'ombres diurnes, selon les besoins fonctionnels ou esthétiques. La coloration artificielle des zones lumineuses diurnes.*

Even more incredible than his plan to focus the interventions of light, however, was Schöffer's proposal to manipulate the weather. "Climate," another topology, was qualified to mean "temperature, humidity, and wind"[43]—aspects of the environment that, even under the best of circumstances, are difficult or impossible to isolate and modify.[44] Not surprisingly, Schöffer provides little in the way of technical details for how this system might work, saying only that the weather would be subject to cybernetic modification. And yet, it is clear he did have specific modifications in mind—changing the weather, he wrote, can "help stimulate, neutralize, or calm."[45] Schöffer furthermore believed it would be possible to implement these modifications. Marginally plausible was his plan "to create artificially protected and air conditioned areas around homes to avoid the traumatic effects of climatic oscillations,"[46] but it remains unclear whether fully implementing this topology would require enclosing the city itself with a giant dome, or some other large-scale shelter.

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[43] Ibid., 117.

[44] Climate modification conspiracy theories aside, of course.

[45] Schöffer, La Ville Cybernétique, 117.

L'organisation des climats doit s'adapter harmonieusement aux fonctions des lieux et contribuer à stimuler, à neutraliser ou à décontracter, c'est-à-dire à déterminer, les conditions optima de l'ambiance climatique des ensembles habites.

[46] Ibid.

Dans les zones saturées de froid, de chaleur ou d'humidité, il sera nécessaire de créer des zones artificiellement protégées et climatisées autour des habitations afin d'éviter les effets traumatisants des alternances climatiques.

A 'Sound' Topology

Closely associated with the topologies of weather and time is that of "sound," which Schöffer neatly, if problematically, divides into two subcategories. The first includes sounds that are "natural" and which, he says, produce a pleasing indeterminacy. By his estimation, this category includes sound made by animals, wind (such as rustling trees), and other inorganic phenomena (like gurgling streams).[47] The second category is "artificial" sounds—which is not to say "sounds that are not really sounds," but rather sounds that have a human or otherwise industrial origin.[48] Though unwieldy, these subcategories sketch a baseline aural configuration for the Cybernetic City: while "natural" sounds would require no modification or intervention whatsoever—they could, in essence, be enjoyed and appreciated as-is—the latter would need to be eliminated or suppressed all but completely, especially when perceived as unwelcome.[49]

In practice, the topology of sound is closely related to that of rhythm, since different sounds are unavoidably linked to the activities that generate them. For instance, in order to keep the city temporally ordered, its inhabitants unperturbed, Schöffer envisioned the need to divide the city into sonic zones—not unlike the use-zones of Corbusier's "Radiant City," or those found throughout today's suburbia—that would keep especially industrial activities isolated on the urban edge. Aside from sheer physical distance, though, artificial sounds would also be counteracted through various creative

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[47] Ibid., 116.

[48] Ibid.

[49] Ibid.

means: noise cancellation, suppression, insulation, or other such "technical processes."[50]

But relative silence was by no means universally ideal. On the contrary, Schöffer believed

noise would be common, even welcomed, in areas of leisure and recreation—though

surely not those of sleep.

Sound would also have an important role to play within several specific buildings

in the Cybernetic City. One of them is the Spatiodynamic Theater, imagined to be the

most important entertainment and cultural venue in the city. The theater would consist of

a slowly rotating hyperbolic shell 100 meters across. Its interior surface would be left

bare so as to host a range of performances: from what he called "moving poems," to

cybernetic ballets (performed by humans and machines), and other kinds of audio-visual

shows. Spectators, meanwhile, would be free to move among different areas inside. The

technical operations of the theater, however, were by no means simple, and Schöffer

explained in great detail how they would work. Much more than a site *for* performance,

the building itself could move and change along with the multimedia art works performed

inside:

> Sound is broadcast in stereo, generally in the direction opposite to the rotational movement of the public, who perceive the projections in all portions of visible space. The entire show is directed by an electronic control tower, located at the top of a central cylindrical frame. The programming of the spectacle is composed and recomposed constantly to avoid any sense of repetition ... To establish non-saturation, the varied rotation of the public also plays an important role. Multiple perspectives, moving sounds, varied rhythms, smells, and climatic changes actively unfold during the show, without a beginning or an end. Spectators, upon entering their box, encounter a set of rhythmic sensations whose unfolding does not pass unnoticed. In front of each spectator is a control panel that allows them to

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[50] Ibid.

> *Ces sons, par contre, devront être plus ou moins éliminés et il faut prévoir leur neutralisation ou leur localisation dans des lieux où ils ne sont pas gênants ou bien encore leur réduction par divers procédés techniques.*

communicate impressions or commands to the control tower, which are constantly
quantified, and that influence how the program unfolds.[51]

The Spatiodynamic Theater was designed, then, as a mini-Cybernetic City: modeling not

only the same kinds of participatory (inter)action that would define urban experience, but

the same types of creative, specifically sonic, adaptation.

Schöffer's description here might also be said to share much in common with

other multi-media and installation art venues, notably the Philips Pavilion constructed for

the World's Fair in Brussels in 1958—nearly ten years before the publication of the *La*

Ville Cybernétique. While this comparison seems apt, Schöffer's Spatiodynamic Theater

nonetheless differs in two important ways. For one, the Pavilion was a stand-alone space,

constructed among other stand-alone spaces. It was, even according to Corbusier's

drawings, an "organ without a body:" a metaphorical stomach where immersive artwork

is digested by viewers, but otherwise unconnected to the surrounding environment.[52]

Schöffer's theater, by contrast, both inside and out, functioned seamlessly as part of an

integrated urban-artistic program. Even though it could conceivably have been built

without the larger context of the Cybernetic City, the conceptual line dividing the two is

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[51] Ibid.,131-33.

> *Le son est émis en stéréophonie, en général dans le sens opposé au mouvement de rotation du public qui perçoit les projections dans toutes les fractions de l'espace visible. L'ensemble du spectacle est dirigé d'une tour de contrôle électronique, située au sommet du bâti cylindrique central. Le programme du spectacle est composé et recomposé constamment pour éviter toute sensation de périodicité, grâce au répertoire disponible. Pour obtenir la non-saturation, la rotation variée du public joue elle aussi un rôle important. Visions multiples, sons en mouvement, rythmes toujours variés, odeurs et climats projetés participent activement au déroulement de ce spectacle sans commencement ni fin. Le spectateur, en entrant dans sa loge, perçoit un ensemble de sensations rythmées dont le déroulement ne lui échappe pas complètement. Devant chaque spectateur est placé un tableau de commande qui lui permet de communiquer à la tour de contrôle ses impressions ou ses ordres qui, sans cesse quantifiés, influent sur le déroulement du programme.*

[52] Marc Treib, *Space Calculated in Seconds* (Princeton: Princeton University Press, 1996), 26-27.

very narrow. This observation mirrors the second important difference: if the Philips

Pavilion can be understood as a discrete, if not disguised, advertisement for Philips-

branded consumer electronics, then the Spatiodynamic Theater puts its relationship to

consumption in the open. In spite of his concern about quantity-driven *médiocrisation*,

Schöffer nonetheless identifies the Spatiodynamic Theater as one of the few places within

the Cybernetic City where residents would be able to shop.[53]

Despite how well-planned the integration of sound promised to be, Schöffer

seems not to have anticipated the full extent to which "artificial" sounds would seep into

everyday life. His diagrams, for instance, depict activities in "residential" areas that

would surely be the source of acoustic annoyance. Helicopters, for one, appear in almost

every sketch he produced: landing on rooftops and hovering near office and university

buildings. (Fig. 5-1.) Elsewhere, cars can be seen speeding along wide boulevards, built

to "allow for direct and rapid movement," but without any physical acoustical barriers.[54]

These apparent contradictions are nowhere addressed in Schöffer's writing; and this

suggests either that sonic-cybernetic mitigation would be quite aggressive, or more likely,

that the conflicting priorities he described—helicopters *and* relative quiet in areas of

leisure and sleep—were not adequately considered.

It is also in the topology of sound that the Cybernetic City itself begins to emerge

as a work of art. While it would be possible to develop *ad hoc* accommodations for other

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[53] Schöffer, *La Ville Cybernétique*, 131. He writes:

> *Ce dernier contient un centre commercial évoqué précédemment. Le public peut circuler aisément entre le centre commercial et les loges des spectateurs, bien que le dispositif hyperbolique contenant les loges tourne lentement à des vitesses variées et dans les deux sens.*

[54] Ibid., 106.

topologies, sound in particular would require significant advanced planning. The active

sonic material of the city—as opposed to suppression or mitigation techniques—would

become something akin to the music of ordinary life and would consequently require

"great craft and skill" to be organized.[55] Indeed, while Schöffer viewed music in general

as something of a lagging indicator—and, moreover, believed the so-called "music of

ideas" had failed to achieve its aims[56]—he nonetheless believed composers were

particularly well-suited to the task. Composers, he said, possess the skills, knowledge,

and discipline to manipulate sound in order to achieve specific effects.[57] But because

urban design is not a task to which they are usually accustomed, it would become an

interdisciplinary endeavor with composers at the lead—directing technical workers from

other fields.[58]

While Schöffer never explains exactly what kind of music might be composed for

the Cybernetic City, he nonetheless includes a small notational fragment that offers some

hints. Included alongside the textual explanation for each topology is a small sketch that

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[55] Ibid., 116.

[56] Ibid., 93.

> Toutes les tentatives pour créer une musique d'idées ont échoué. Les plus grands créateurs, J.-S. Bach, Haydn, n'ont recherché que la sublimation de pures structures d'effets. Ceux qui ont essaye de faire une musique d'idées, comme Wagner, Verdi, Tchaikovsky par exemple, ont nettement échoué.

[57] Ibid., 116. He explains: "Il est logique que le bâtisseur manie ce matériau de première importance avec art et compétence."

[58] Ibid., 93.

> L'organisation des effets esthétiques sonores, dans les ensembles audio-visuels et dans l'urbanisme, sera d'une importance primordiale. Mais le créateur d'effets sonores esthétiques sera obligé de s'intégrer dans de larges équipes de créateurs artistiques et de techniciens spécialisés, qui, ensemble, élaboreront des œuvres audio-visuelles collectives.

"performs" the imagined interaction among experiential and environmental elements.

Schöffer's notation for weather, for instance, shows swirls and dots, illustrating the the

transformation of cold, dry air into a more temperate environment. (Fig. 5-4A) The

diagram for sound, however, shows lines, squiggles, and zigzags at varying vertical and

horizontal distances—marks which very much resemble avant-garde musical notation

used by Luigi Russolo, Karlheinz Stockhausen, or Edgard Varèse.[59] (Fig. 5-4B) The

sharpness of these marks, their relative precision, implies the use of electronic sound—or

at least, suggests electronic sound would not be unwelcome. And indeed, if the music

Schöffer broadcast from *Chronos 3* is any indication of what the Cybernetic City would

sound like, this inference is justified.

Cybernetic Towers

Of the many technological components Schöffer planned for the Cybernetic City,

none was as integral as the cybernetic towers. Towers, in one form or another, appear in

virtually every sketch and visual example Schöffer produced: sometimes human-sized

and self-propelled, capable of roaming the city freely on their own; at other times taller

than skyscrapers, fixed in place, able to broadcast a spectacle of sound and light into the

urban environment. His CYSP—short for "cybernetic sculptures"—were human-sized

towers, standing between 2 and 6 meters high. And like larger, later examples, they were

equipped with myriad sensory attachments, allowing them to move throughout a

performance space while reacting and interacting to both human and environmental

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[59] For an example of notation used by Varèse, specifically his sketches for the *Poème électronique*, which has particular relevance to the Cybernetic City and the Spatiodynamic Theater, see: Treib, *Space Calculated in Seconds*, 198-201, figures 5-10 and 5-11.

change.[60] A cross between public art and public utility, these towers were the primary

mechanism for observing and modifying fractional space: thoughtfully, creatively, but

never to disturb. He explains how

> ...their increased agitation may, for example, announce bad weather. In such a case, at certain times of day, they will act as a true barometer. At other times they will give all sorts of information about the economy, sports, politics, etc.[61]

But the towers also had a symbolic function. They occupy the physical site, become the

physical manifestation, of an otherwise invisible network of power and control.

It is important to recognize, however, the extent to which Schöffer's plans for

cybernetic towers predates the publication of *La Ville Cybernétique*. *Chronos 3* has

already been discussed at some length; but other, similar towers can be found even

earlier. During the 1950s, for example, Schöffer created the first self-directed, self-

propelled sculpture—one able to travel throughout the city entirely on its own. Others he

made were capable of interacting dynamically with humans. Conceivably let loose to

roam the city on their own, sculptures like these, Schöffer believed, would lend "a

maximum of dynamism to the spectacle of the street."[62]

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[60] Joray, 60; Schöffer, *La Ville Cybernétique,* image opposite page 105.

[61] Schöffer, *La Ville Cybernétique,* 129.

> ...leur agitation accrue pourra, par example, annoncer le mauvais temps. En ce cas, à certaines heures de la journée elles joueront le rôle de véritables baromètres. A d'autres moments elles donneront des informations de toutes sortes, économiques, sportives, politiques, etc.

It is not clear what Schöffer means by "agitation" in this passage. While mobile towers would have the capacity to broadcast sound electronically, to announce economic and sports news, it is possible that agitation could be expressed mechanically.

[62] Ibid., 60.

One of his most fully-developed and fully-realized cybernetic towers was erected

in the Park at St. Cloud, on the outskirts of Paris, for the International Building and

Public Works Exhibition in 1955. Using equipment manufactured by the Philips

corporation, the tower was designed to produce a multimedia spectacle integrating light

with music and movement—all of which was guided by a dynamic computer program

capable of responding to environmental fluctuations in real-time.[63] Musical interventions,

though, were among the tower's most novel features. As consulting engineer J. Bureau

explained, the tower would

> ...produce anharmonic musical motifs, many of which will be of no great interest and
> will constitute a background of sound, while others will appeal to the ear. The sound
> material ... will always be interesting and rich.[64]

The source for these "anharmonic musical motifs" would be *Spatiodynamisme,* a work of

musique concrète specially composed by Pierre Henry.[65] Microphones attached to the

tower's superstructure would observe ambient sound as it occurred. These observations

would later be processed through a central computer brain, which would analyze them to

determine how to "balance and avoid discordant sounds."[66] Under the "correct"

conditions—which changed over time, thanks to a built-in randomizer—music would be

played to counteract or complement what was already audible.

But Bureau is wrong to say, as he does above, that any part of *Spatiodynamisme* is

of "no great interest." While the first few minutes are relatively sparse—functioning, as

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[63] Ibid., 45.

[64] Quoted in Joray, 45.

[65] The earliest available recording of *Spatiodynamisme* is from 1963 and is published in two parts
on a 45rpm disc included with Joray's *Nicolas Schöffer.*

[66] Ibid., 46.

in many works of tape music, to introduce each new sound in sequence—the next few gain tremendously in complexity. Density and texture in particular are played with in interesting and compelling ways. For instance, a crescendo, beginning at the 1:35 mark eventually builds into a frenzy of activity lasting two minutes, continuing until a sudden scraping sound interrupts. (Fig. 5-2A) This is followed by a momentary return to calm, a new section of harsh bangs, rapid and abrupt tape cutting, and a noticeable increase in the diversity of timbre. Arguably the most striking moments, however, occur at the 17-minute mark, when a brief clip—what sounds like wooden sticks being dragged along the arms of the tower itself—is looped almost hypnotically for nearly four minutes without interruption. (Fig. 5-2B)

The tower in St. Cloud was not simply a tool for city-wide broadcasting, the equivalent of an air-raid siren or tornado warning system. It was, rather, meant to improve how people live and what they hear on a daily basis, in part by broadcasting sonic references to itself. Many of the clips collaged in *Spatiodynamisme* sound as though they were produced by the tower: sounds of metal creaking and wobbling in the wind, the sound of scrapes (as if made by bird's claws), bangs, and rattles (as if made by hail or debris blowing in the wind). At the same time, there is nothing deceptive or deceitful about how *Spatiodynamisme* was produced. Even in the final recording, the medium is always apparent. Much of the 23-minute piece features quite roughly-executed tape processes common to the 1950s: layering, looping, and cutting. From another point of view, this very roughness seems appropriate, since the tower was never meant to hide its technological operations.

Two decades after the tower in St. Cloud was built, Schöffer proposed his most ambitious project yet. Planned for construction in La Défense, and imagined to stand an impressive 300 meters high, it was called the "Tour-lumière cybernétique." In addition to being his most practical tower, if built, it would have left a profound mark on the landscape.[67] Its luminodynamic interventions, for instance, were designed to target the roadways: like giant highway lamps, the lights mounted on its superstructure would be activated automatically as weather conditions began to deteriorate. A similar process would hold true for sound. Not only would information about ambient urban noise be collected and processed by a central cybernetic brain, but some sort of (unspecified) sonic amelioration would be introduced to combat audible unpleasantness.

Far from being outliers, the towers Schöffer imagined for the Cybernetic City fit comfortably within his broader works. They were, first and foremost, vehicles for making connections—between individuals, people and computers; between technology and the environment. But they were also a key demonstration of the city as a dynamic and changing place, an exemplification of how fractional space can become the very site and source of creative engagement, rather than simply a means to suppress perturbation and annoyance. Though seeming stoic, they would serve as a visible and indeed audible reminder that the city can be made into a work of art, an ongoing and indeterminate composition. In that sense, the towers had both practical and ideological elements: whether large or small, fixed in place or self-directed, they were to become vehicles for social and aesthetic transformation.

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[67] Nicolas Schöffer, *La tour lumière cybernétique* (Paris: Denoël, 1973).

As Schöffer wrote, "everything moves, or we can make it move."[68] And indeed,

coaxing both the moveable and seemingly immovable aspects of everyday life to action

was among the most central functions of cybernetic towers. Not only did Schöffer believe

fractional space *could* be articulated creatively, he believed that it was filled with creative

potential that *should* be created-with for the benefit and enhancement of ordinary life.

Alternating between stability and instability—between being pleasant, useful, and

surprising—each topology would be anticipated, organized, allowed to unfold, then

artistically responded to. The outcome would encourage people to develop a critical

awareness of their surroundings rather than contribute to *médiocrisation*, all while

playing an active role in their own wellbeing.

Though seldom discussed in scholarly literature on the subject, Schöffer's towers

seem to have anticipated more recent developments in sound installation art.[69] One

example is "Airport Sound Experience," a 1996 installation at Cairns International

Airport by Peter Mumme. This computer-controlled project was "synchronised with the

airport flight schedule," and at opportune moments, would introduce sound collected

from the natural environment, including birds and water, to complement or contrast with

changes in the ambience or activity level of the surrounding space.[70] Another clear

beneficiary, Richard Serra's "Berlin Junction," was installed beginning in 2001 outside

[68] Schöffer, La Ville Cybernétique, 112. "...tout objet, être, phénomène naturel ou artificiel qui peut se mouvoir, ou que l'on peut faire mouvoir."

[69] Gascia Ouzounian, "Sound Art and Spatial Practices: Situating Sound Installation Art Since 1958," PhD diss, University of California, San Diego, 2008. Ouzounian is the only scholar in music I have found who mentions Schöffer's cybernetic towers.

[70] Ros Bandt, "Designing Sound in Public Space in Australia: a comparative study based on the Australian Sound Design Project's online gallery and database," Organised Sound 10, no. 2 (2005): 133.

the Berlin Philharmonie. This work consists of two large metal slabs, each molded into a slight curve, balanced on one edge, roughly parallel to each other. The result is a narrow corridor; and as visitors venture inside, sensors hidden in the walkway beneath are tripped, causing an already-present background sound to change and respond to their movement. Much like Schöffer's tower at St. Cloud, these inputs are fed through a computer system located in the foyer of the nearby Philharmonie. "Over time," as critic George Klein has explained, "visitors cause the sound to change day and night. Listeners transform what they hear. The visitors become players in a musical process lasting months."[71]

"Players," writes Klein, but arguably only after an initial gesture of intent. That is to say, unlike Schöffer's towers, Serra's installation only becomes active (and interactive) after a person goes out of their way to venture inside the metal corridor. By comparison, Schöffer's towers at Liège and St. Cloud—in addition to those planned for La Défense and the Cybernetic City—were programmed to engage automatically with the environment on a massive, city-wide scale. More importantly, they were designed to respond to both purposeful and un-purposeful action, both intentional and unintentional engagement. While the desire for change could be registered by listeners, it could also be initiated automatically by the computer program, without the need for any direct interaction at all, at the very instant a "perturbation" could be detected. Schöffer's sonic interventions, then, unlike "Berlin Junction," were preprogrammed to be responsive.

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[71] Georg Klein, "From the Sound Installation to the Sound Situation: on my work *transition – berlin junction eine klangsituation," Organised Sound* 8, no. 2 (2003): 187.

Section II: Criticism

Schöffer's ambitious and far-reaching plan—which seemed to idealize an already-aestheticized hierarchical scripting of everyday life—has been greeted quite skeptically. Critiques of his work follow one of two paths. The first is more or less direct criticism, aimed at problematizing both the specifics of what Schöffer hoped to achieve and the larger social and political implications of the final result. The second path is a more general historical critique, framing the Cybernetic City as symptomatic of a naive techno-utopianism.

The latter is best exemplified in the recent work of architectural historian Larry Busbea. In his book *Topologies,* he explains how Schöffer's vision for a technologically-controlled, aesthetically-planned city of the future can be situated among a small group of utopian theorists associated with the Groupe International d'Architecture Prospective (GIAP) after the Second World War.[72] While any number of visionaries and utopians independently proposed novel configurations (and reconfigurations) of the city—including composer and architect Iannis Xenakis[73]—the GIAP is especially notable for its interest in semiotics. To its members, the meaning, purpose, and most importantly, structure of the city had been obscured following the influx of American-style consumer capitalism after the Second World War. One goal of the GIAP, then, was to find ways to restore "semiotic consistency" to the city—which had been disrupted by cars, advertising, and thoughtless growth and development. Art would have a crucial role to play—not

[72] Busbea, *Topologies.*

[73] Iannis Xenakis, *Arts-Sciences, Alloys,* trans. Sharon Kanach (New York: Pendragon Press, 1985); *Musique, architecture* (Paris: Casterman, 1976).

merely a recursive one, operating "via the critique of its ideological superstructure," but

rather more directly, by turning "its technical mechanisms" toward "aesthetic ends."[74]

Schöffer, in that sense, achieved some significant and concrete successes—at least

compared to many of his peers. The cybernetic towers were designed as large-scale

demonstrations for how everyday life could, in some measure, be "improved" by

technology. But he also succeeded in having a limited number of small-scale consumer

goods manufactured. His goal, rather than creating yet another art object, was to

introduce a sense of artful *change* into everyday life—change in and of itself, not always-

already commodified change, like television programming. The Lumino, for instance,

was a tabletop, TV-like device designed to do nothing more than show a slowly-moving

spectacle of colored light and abstract shapes. 1,500 were manufactured by the Philips

corporation; and a further batch was produced by Clairol in the United States, marketed

and sold as the "Dream Box."[75]

Whether or not these devices actually can, in the end, do anything as ambitious as

"restore semiotic consistency," the belief was that they could expose Schöffer to political

and cultural critique. Among his most vocal critic was Jean Baudrillard, who, along with

noted spatial theorist Henri Lefebvre, was a contributor to the periodical *Utopie* during

the mid-1960s. Baudrillard's critique emerged as part of a much broader condemnation of

"functionalism"—which Baudrillard believed could be traced to the Bauhaus school of

architecture and design. Functionalism, he thought, was worrisome because it marks the

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[74] Busbea, *Topologies,* 171.

[75] "The Lumino - 1968," http://www.olats.org/schoffer/lumin.htm (accessed 30 Nov 2012).

extension of aesthetics "to the entire everyday world."[76] If all that previously existed

were "things"—objects not created to fill a specific function, not designed with a

particular use in mind—then it was the Bauhaus that marked "the *theoretical extension of*

this field of political economy and the practical extension of the system of exchange value

to the whole domain of signs, forms and objects."[77]

To Baudrillard, functionalism marked the rising importance of signification as

such. This had the effect of further cementing the connection between object and purpose

—even to the point that an object itself came to signify that purpose. A chair, in this

sense, is not just a thing, but also information: about where one can sit, about what kind

of activities can be done while sitting in it. Objects, as a result, become a quick and easy

way to communicate. And this, at least as far as the consumption of material goods is

concerned, has a problematic and unintended effect: the emergence of a social age whose

principal concern was clear communication. As Baudrillard explains, the spirit of the age

is articulated by a belief that "the more signs there are, the more messages and

information there are, the more one communicates—the better it is."[78]

Of course, communication may not necessarily seem like a bad thing, since clarity

and transparency would presumably enable a more thoughtful and critical engagement

with the world. But here, "communication" has a double meaning. It inidcates the

growing influence of material consumption, along with a corresponding "'irrational' or

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[76] Jean Baudrillard, "Design and Environment," in *For a Critique of the Political Economy of the Sign,* trans. Charles Levin (St. Louis, MO: Telos Press, 1981), 186.

[77] Ibid.

[78] Ibid., 199.

'fantasy' counter-discourse, which circulates between the two poles of kitsch and surrealism."[79] The resulting impasse suggests two possible outcomes: the first, a re-emergence of the very same social and political "contradictions" that drove functionalist design in the first place; the second, the one Baudrillard seems to think is more likely, an "intensification of the play of signifiers, a mathematization and cybernetization of the code."[80] The latter, indeed, can be quite clearly seen today in neo-liberal economics, which has brought an "irrational exuberance" for ever more data.

Baudrillard believed adopting technological solutions to the management of everyday life was tantamount to "blind faith."[81] All that would remain of the natural environment, which is to say, the undifferentiated space not territorialized by capitalist production and aesthetic functionalism, would be little more than a parody, "a simulation model," an empty reference to a more meaningful relationship to the world and the past.[82] He worried that, by embracing this kind of change, we would move from a complex society, one that is "contradictory, non-homogeneous, and not yet saturated with political economy,"[83] to one where "abstract communication and an immanent manipulation no longer leave any point exterior to the system."[84]

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[79] Ibid., 192.

[80] Ibid., 192.

[81] Ibid., 199.

[82] Ibid., 202.

[83] Ibid.

[84] Ibid.

In attempting to recover the very notion of reality, a truly cybernetic city would in fact be a hyperreality.[85] And indeed, on its surface, Schöffer's vision might be viewed as a kind of urban Disneyland.[86] Each element, in each area, is carefully designed for a specific purpose, and in many cases is controlled by computer, with the goal of maintaining a certain atmosphere: not just literally, in terms of temperature, lighting, and sound, but affectively, in terms of what we feel and experience as we move through it. Space, indeed, as Baudrillard understood it, is produced by the "field of signifiers generated by the objects within it."[87] And to manipulate space at the level of effects is to guarantee subjective alienation—doing so forces adherence to an imposed script, lived in an "endless, meaningless permutation," that distances ordinary people from the underlying reality of their condition.

Baudrillard, it seems, found little or no redeeming qualities in Schöffer's city: it exemplified what he called, "operational metadesign."[88] Despite their apparent differences, however, Schöffer and Baudrillard have a few concerns in common. While Baudrillard never uses the term *médiocrisation*, it seems clear that his concern for too

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[85] Jean Baudrillard, *Simulacra and Simulation*, trans. Sheila Faria Glaser (Ann Arbor: The University of Michigan Press, 2006). He explains: "[i]t is no longer a question of a false representation of reality (ideology) but of concealing the fact that the real is no longer real, and thus of saving the reality principle." (13) Meanwhile, the overall effect of hyperreality is to conceal "that reality no more exists outside than inside the limits of the artificial perimeter." (14)

[86] Ibid., 12. Baudrillard explains:

Disneyland is presented as imaginary in order to make us believe that the rest is real, whereas all of Los Angeles and the America that surrounds it are no longer real, but belong to the hyperreal order and to the order of simulation.

[87] Larry Busbea, "Toward Superland: ambient objects and environmental semiotics in France, c. 1965," *Architecture + Art: new visions, new strategies*, International Alvar Aalto Research Conference on Modern Architecture, Jyväskylä, Finland (2007): 162.

[88] Baudrillard, "Design and Environment," 198.

much communication, and too many signifiers, bears much in common with the problem

of *médiocrisation,* as defined by Schöffer. Furthermore, Baudrillard, like Schöffer, was

openly critical of capitalist alienation, in addition to the uses and abuses of modern art.

Both dislike "pop" and surrealist art, which they viewed as responsible for dumbing-

down and withholding knowledge from ordinary people. But Baudrillard, unlike

Schöffer, believed surrealism in particular, once properly contextualized, should be

understood as integral to functionalism. The two, he wrote, are "inseparable, like the

monstrous, anomic critical discourse of objects."[89]

> [Surrealism] plays upon the *distance* instituted by the functionalist calculus between
> the object and itself, or between man and his own body, upon the distance between
> any term and the abstract finality that is imposed upon it, upon the cleavage that
> makes men and things suddenly find themselves split apart as signs and confronted
> with a transcendental 'signified'.[90]

At the same time, though openly wary of meta-design, Baudrillard never directly objected

to any particular part of Schöffer's plan. Indeed, from a certain point of view, the towers

can be said to pose an interesting challenge to his critique, principally because they did

not have a fixed program, a fixed purpose, or a fixed repertoire of "effects." The sound

they produced, while already-aestheticized, was aimed only at creating a more pleasing

ambience—whatever that meant at any given time, however it needed to occur, according

to whoever happened to be listening.

This, in turn, suggests Baudrillard's two most pointed objections to Schöffer's

work—that it represented the peak of functionalism; that its goal to manipulate the city

on the level of effects facilitated only greater alienation—are off target. After all, the

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[89] Ibid., 193.

[90] Ibid.

towers had no stable or ideal function, other than change itself. Certainly, the city was designed with a purpose in mind—that is to say, regulating the urban ambiance—but the specific regulations themselves would be left open. Baudrillard's concern, that the Cybernetic City presented a vision of structured "effects," seems to lack teeth, since the very effects with which he was concerned more closely resemble feedback loops, whose moment-by-moment configurations were reflected back on the already-observable ambience of the urban fabric.

Perhaps a better, more focused critique of Schöffer is that his plans merely defer answering difficult questions about agency. For instance: What would happen if two people with different aesthetic tastes—who experience sound and are "perturbed" by different things—attempt to influence the sonic ambience in conflicting ways? According to Schöffer's vision, the computer input consoles, working in consort with the central cybernetic brain, would develop a solution automatically. But this only begs the question, since relying on a computerized compromise merely shifts the location of the problem: from the divergent tastes and perceptions of listeners, to the computer programming itself. So indeed, while Schöffer's vision does provide a plan for how sonic indeterminacies might be incorporated creatively, it ducks difficult questions about human variables.

Indirect Criticism

This final observation opens another line of critique, though an indirect one, that asks how Schöffer's theorization of sound might be said to prefigure social relationships. The central question here was addressed at great length by Jacques Attali in *Noise: The*

Political Economy of Music. One of Attali's central contentions is that social structure cannot be understood simply by studying what can be seen. "More than colors and forms," Attali writes, it is "sound and their arrangements" that give shape to society.[91]

From this point of view, Baudrillard's concerns about functionalism, intersecting as they do with the materials economy, are more like symptoms than causes. Limiting our critical gaze to consumer goods and their relationship to the political superstructure would consequently be too narrow. More telling, Attali says, is sound: the way it first "links a power center to its subjects, and thus, more generally ... is an attribute of power in all of its forms."[92] Where Baudrillard and Attali both agree, however, is that the underlying social fabric is structural. Life, that is to say, is filled with "codes" that "analyze, mark, restrain, train, repress, and channel" how we interact with the world.[93] The crucial difference is that, for Attali, these codes manifest first in what is audible, only to appear later in more tangible forms, like new modes of political authority, consumables, architecture, and entertainment. Sound therefore should be understood as a leading indicator of a developing political order—rather than merely its byproduct.

But to understand what this means for the Cybernetic City, it is necessary to understand a few key parts of Attali's analysis; namely, that it is fundamental that society, read through the filter of sound, suggests several discrete phases of development. The first is what he calls "sacrificing," and it begins with an act of symbolic violence.[94]

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[91] Jacques Attali, *Noise: The Political Economy of Music,* trans. Brian Massumi (Minneapolis and London: University of Minnesota Press, 1985), 6.

[92] Ibid.

[93] Ibid.

[94] Ibid., 25.

Sounds that are welcome and wanted are labeled "music," while those that are

unwelcome are marginalized, labeled "noise." The result, Attali says, is that the very

notion of "music" plays a negative function: it is used, in part, to distinguish insiders

from outsiders, to channel and define social acceptance, while allowing for the

development of "social order and political integration."[95] Governing and political

authorities later assume control of this process in much the same way as they assume

control over violence—what Althusser elsewhere called "repressive" authority.[96] They do

it by "monopolizing control over the deployment and definition of music," in order "to

keep noise from spreading."[97]

The second phase, called "representing," is marked by the emergence of a sonic

marketplace. This does not necessarily refer to technologies of sound reproduction, but

rather the process by which the violence inherent to sacrificing acquires an economic

cloak. Music, Attali explains,

> did not emerge as commodity until merchants, acting in the name of musicians,
> gained the power to control its production and sell its usage, and until a sufficiently
> large pool of customers for music developed outside the courts, for which it had been
> formerly reserved.[98]

As the political and economic interests of composers, patrons, and performing musicians

among others came increasingly to conflict, the ability to define music was also balanced

precariously. Ultimately, the democratization of printing resolved this tension by allowing

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[95] Ibid., 26.

[96] Louis Althusser, "Ideology and Ideological State Apparatuses," translated by Ben Brewster, *Lenin and Philosophy and Other Essays* (New York: Monthly Review Press, 1972).

[97] Attali, *Noise*, 28.

[98] Ibid., 52.

powerful, authorial interests to merge with strong legal and political backing.[99]

Representing, in that respect, also facilitated the elevation of music, the belief in its

"universal value, in its impossibility outside of exchange."[100]

The third phase, called "repeating," constitutes "a fundamental change in the

relation between man and history."[101] It is marked by the transformation of time into

money—a transformation that asks people to "believe in the stability of the links between

things and in the indisputable harmony of relations." Repeating brings the introduction of

music to everyone in every place: "in all of the world's hotels, all of the elevators, all of

the factories and offices, all of the airplanes, all of the cars, everywhere..."[102] As in

sacrificing, this "total" sonic environment, this always-already saturation, effects an

ominous silencing, one whose principal effect can be heard in the diminished effectivity

of aural signifiers.[103] This loss of power, the inability to make sound mean something, has

other political effects too, some of which can be seen, he writes, in "a cybernetician"

who, "transcended by his own tools," allows an inversion: "instruments no longer serve

to produce the desired sound forms ... but to monitor unexpected forms."[104] In the end,

this (unnamed) cybernetician is as much the victim of "repeating" as anything else. S/he

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[99] Ibid., 54.

[100] Ibid., 57.

[101] Ibid., 101.

[102] Ibid., 111.

[103] Ibid., 113.

[104] Ibid., 115.

is little more than a hostage to the existing social order, "a spectator of the music by his computer."[105]

This steady progression—from unqualified sound to its emergence as a mechanism of corporeal and environmental control—suggests an uncomfortable observation about the Cybernetic City: the latter two phases Attali describes, representing and repeating, would seem to occur nearly simultaneously. That is to say: Schöffer assumes from the very beginning that the urban ideal is sound saturation. This alone would seem to signal, as Baudrillard suggested, that the power "to mean" has already ended, and that the power "to signify" has been already appropriated up the cybernetic chain. Even more striking is the way Schöffer's vision would seem to ask us to relinquish control over the everyday sonic environment. As in "repeating," sound is not something the composer working within the Cybernetic City is directly responsible for. Rather, as Attali suggests, s/he becomes its spectator: responsible only for setting the initial program into motion, and not for any particular outcome. So, if Attali is right—if the socio-structural function of sound is most worthy of our concern—then Schöffer's plan would seem to distill everything that is worrisome about the initial act of sacrificing. Not only do the towers condense power technically, they also mark the physical site where the ordinary people relinquish their ability to control sound to the machines.

Because Attali was involved with French politics and civil service throughout the 1960s and 70s, he was likely aware of Schöffer's work—especially his proposal to build

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[105] Ibid.

the cybernetic tower at La Défense.[106] And yet, despite their apparent differences, Schöffer and Attali share many concerns. Both, for instance, were clearly troubled by the uncertainty they observed: the rise of consumerism and a general decay in social consciousness. This overlap consequently warrants asking whether there is any space for reconciliation—and indeed, whether Schöffer's plan to map and manipulate the sonic indeterminacies of the city is as terrifying as it first seems.

Reconciliation

At first glance, Schöffer's vision appears frightening: it proposes a city where sensation itself has been subject to almost totalitarian control. Conceivably, every sound one might expect to hear—simple or complex, mechanical or natural; from people talking, to street musicians performing, to birds chirping—could be manipulated or suppressed automatically. And if, as Attali argues, new forms of sonic control anticipate new forms of political and social control, then Schöffer's plans for sound in particular would seem to be ominous: the first page of a dystopian blueprint, an almost inhuman future, where power is exercised anonymously and ubiquitously, and with such a sense of routine that it has been pre-coded both literally and figuratively into the very structure of everyday life.

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[106] Schöffer, *La tour lumière*, 73; Historian Larry Busbea seems skeptical that the tower was as close to construction as Schöffer suggests:

> *Who knows how close this mammoth structure ever was to being constructed. Even if it carried de Gaulle's approval, surely it would not have been so heartily embraced by Pompidou, and certainly not by Mitterrand. Obviously, the Défense tower was meant to be the Eiffel Tower of the twentieth century—a new Parisian monument, located in the new business development that was ... also quickly becoming a cultural center as well.* (Busbea, *Topologies*, 136.)

But this is arguably a cynical view, one that makes sense only in so far as we overemphasize a few key aspects of the Cybernetic City. First, it is important to not exaggerate the role of machines, since Schöffer's plan left ample space for both autonomous and interactive elements. Control panels would be placed throughout the city, including inside housing pods and the Spatiodynamic Theater, for the purpose of encouraging qualitative, *human* insight that could later be combined with sensory information collected by the towers. Ordinary people would therefore be able to contribute directly to the sensory composition of the everyday: flipping switches, twisting knobs to reflect their state of mind. Far from trivial, these behaviors seem designed to encourage the development of good habits, like environmental observation and thoughtful self-reflection. The apparent dependence on machines is really co-dependence, underscoring how the primary aim of the city was not to impose a "new" reality (by covering up a previous one), or to implement a "metadesign" (that leaves nothing un-planned), but rather to respond and react creatively to the city as it already is and can be heard.

Schöffer's vision for the Cybernetic City therefore sits precariously on the boundaries: between technology and architecture; between art and politics; between sound and power. At the same time, the emphasis it places on collaboration, on cooperative creativity, might be said to exemplify the very sort of art-making Attali admired. This perhaps unexpected resonance becomes clear in the final section of *Noise*, where Attali describes with apparent optimism the fourth and future phase of social-sonic development, what he terms "composing." Although it has yet to fully take shape,

it can be seen today, incoherent and fragile, subversive and threatened, in musicians' anxious questioning of repetition, in their works' foreshadowing of the death of the specialist, of the impossibility of the division of labor continuing as a mode of production.[107]

The music of "composing," Attali explains, might be called the music of difference.[108] It appears as "a truly spontaneous music of immediate enjoyment that escaped all crystallizations," but one that, at the same time, "was also very carefully crafted and at times very intellectual."[109] While this description mirrors almost exactly Bureau's earlier comments about *Chronos 3*,[110] it also marks an important shift in the power dynamics of sound-making: it describes the point at which the right to make sound, and to define it as music, is returned to ordinary people—marking the "essential fracture back at the entry of noise into music."[111] At the same time, it is worth mentioning how the "fracture" here is not democratic; it rather evolves over time, part of a developing consensus, established through self-discovery and self-observation: "a blossoming of the body," marked by the ability to define one's own aesthetic tastes and to implement them effectively.[112]

There are three central components to composing. The first is an embrace of process. As sound and music begin to reemerge not as tools of political control, but as expressions of pleasure and desire,[113] the earlier phases of repetition and representation

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[107] Attali, *Noise,* 136.

[108] Attali explains, the goal is "...first of all to take pleasure in the production of differences;" Attali, *Noise,* 142.

[109] Attali, *Noise,* 139.

[110] See page 226 of this dissertation.

[111] Attali, *Noise,* 139.

[112] Ibid., 142.

[113] Ibid., 143.

become frustrated. Music consequently regains its focus "in the present, in production and in one's own enjoyment."[114] The second is novelty. In composing, Attali explains, "stability, in other words, differences, are perpetually called into question."[115] Emphasizing the importance of difference—defined in a Deleuzian sense, as changes discerned through repetition[116]—has the perhaps unintended result of empowering people to resist the fixed control and political appropriation of sound. As a result, sound, a slippery signifier, adapts and conforms to the surrounding milieu. The third component can only be described as "post-capitalism." Attali suggests composing only emerges under conditions of "permanent fragility," one where stable relations—use and exchange, among others—are no longer assumed.[117]

Schöffer's Cybernetic City very strongly resonates with what Attali sketches here. The embrace of process is particularly noticeable: the pleasing ambiance the towers help create is actualized in real-time as a response both to human and environmental changes. And the music they produce in response is never "finished," but rather always different, always unfolding, changing, and adapting. This leads to the second component, novelty. Indeed, if there is one persistent feature in the cybernetic city, it is change itself. As Schöffer recognized, change cannot be avoided or muted—"everything moves"—it can only be played with and responded to. This is the special function of the towers: to monitor change, both human and natural, and to react creatively.

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[114] Ibid.

[115] Ibid., 147.

[116] Gilles Deleuze, *Difference and Repetition*, trans. Paul Patton (New York: Columbia University Press, 1994).

[117] Attali, *Noise*, 147.

Attali also describes how sound and music, in the final phase of composing, can become a kind of sonic "cartography," performed through the incorporation of "local knowledge, the insertion of culture into production and a general availability of new tools and instruments."[118] While using the word "cartography" here metaphorically, Attali nonetheless provides a sketch that explains how and why Schöffer's vision for the Cybernetic City can be understood as a sound map. Indeed, as I argued in Chapter 1, sound maps should be understood not only as graphical representations—showing literally where or how sound can be observed—but also as a way of thinking about sound-space relationships. While leaving room for scientific principles to operate, sound maps encourage us to embrace complexity, to appreciate the pleasing and productive sonic indeterminacies as they can be found already around us.

Read through the lens of Attali's *Noise, La Ville Cybernétique* is not only a work of utopian literature, but a vision for what the city will sound like after the end of the music-noise dialectic. But in a much broader sense, it can also be read as a sound map. This is for several reasons. First, the philosophy underlying it resonates with the belief that space is not simply a "container" for sound. Sound, along with other sensory aspects of everyday experience, are produced together with the physical form of the city—which itself can no longer be analyzed strictly in terms of its spatial, functional, or optical characteristics. The senses, especially hearing, must be actively considered because of the way they are interwoven with form and rhythms of everyday life. The second reason is that Schöffer's plans make an attempt to represent these complex relationships: to map-

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[118] Attali, *Noise*, 147.

out, technically and metaphorically, the way each element reacts and interacts with others. This can be seen not only in Schöffer's drawings and written descriptions, but in his computer schematics, which demonstrate how each element of daily life would be processed within the central cybernetic brain. Though often quite broad—leaving open, in a technical sense, how each element would be manipulated—these diagrams nonetheless demonstrate a keen understanding of the way in which designing the city means creating room for indeterminate sensory input and output.

Finally, the towers and their cybernetic programming define music broadly and inclusively—an approach that resonates with the work of composers like Stuart Marshall and Jocy de Oliveira, discussed in Chapter 4 of this dissertation. But here, in the Cybernetic City, technology comes to play a new and significant role. Not only does it demonstrate awareness of the constructive role of sonic ambience, it performs this ambience turned back on itself, showing how everyday art can be made using everyday sonic materials. Even as Schöffer leaves open the possibility that some sounds would have to be actively suppressed, for instance using "sonic mufflers," *Chronos 3*, among other towers, demonstrated how a particular installation site can become both the site and source of music.

Learning from Schöffer's City

Perhaps the greatest lesson of Schöffer's Cybernetic City becomes clear through studying sociological work on movement and behavior. In his book *Pas à pas,* for instance, Jean-François Augoyard discusses shortcuts: why people take them, how they

rationalize taking them, and how that rationale shapes the kind of shortcut they choose.[119] While this may seem banal, it is the underlying social, environmental, and political tensions—for instance, between the shortcut and the institutionally-approved pathway—that bring to mind serious questions about Schöffer's plans for the Cybernetic City: Should we design for and with sound, accepting that people will inevitably forge their own (sonic) path, create or leave their own (sound) mark? Or do we do provide a "non-plan:" a very loose sonic framework that encourages and accommodates indeterminate action?

Indeed, with regard to the physical environment, architects over the last few decades have experimented with nearly every conceivable answer to these questions—from the playful work of Cedric Price to the anarcho-individualism of Archigram; from the walkable neighborhoods of New Urbanism to the philosophy of historical preservation. Meanwhile, sound artists, composers, and soundscape scholars have adopted a far more limited, indeed conservative, approach. Their work often exhibits a general resignation to the inevitability or unavoidability of "noise;" and in practice, the tendency is to react only when unplanned and unwanted sound has already become burdensome or intrusive—and to respond only by making noise less objectionable, less intolerable, or at the very least, less cheap. This, it seems, is a losing strategy, akin to re-sodding each new foot path through the grass in a popular urban park, or closing-up each and every unapproved passageway in a housing project.

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[119] Jean-François Augoyard, *Step by Step: Everyday Walks in a French Urban Housing Project*, trans. David Ames Curtis (Minneapolis and London: University of Minnesota Press, 2007): 29-40.

The alternative becomes clear at the point where Schöffer's Cybernetic City intersects with the sound map: a city where sensory experience is considered first, rather than last or not at all; an urban environment where sonic indeterminacies become integral to the textural fabric of everyday experience, rather than potential "noise." Schöffer's plan is a radical demonstration of what R. Murray Schafer described at the beginning of this chapter—a leap of the imagination, a schematic that both describes "the ideal city" and provides general plans for "the types of sounds, the permitted intensities, frequencies and periodicities to be featured in different zones."[120] And while some aspects present legitimate cause for concern, it bears asking what Schöffer's imaginative plans can teach us about future attempts to design the seemingly un-designable, to plan what seems unplannable. Three observations come to mind:

1. **Design for change, not consistency**. This is arguably the most direct lesson of the Cybernetic City. While it is easy to imagine how sound design at the urban scale might require nearly totalitarian control, Schöffer's solution suggests something else: that design is possible by engaging *with* what can already be heard, and by only occasionally resorting to outright prohibition or direct suppression. As Schöffer himself writes, "everything moves or we can make it move"—which suggests the most certain way to design for sound is to anticipate its very inconstancy.[121] To do this, Schöffer's specific proposal relies on cybernetic intervention; but there are surely other strategies that are less reliant on technology.

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[120] Schafer, *The Vancouver Soundscape,* 66.

[121] Schöffer, *La Ville Cybernétique,* 112.

2. **Technology has a role to play, but it should not dominate.** If Schöffer is right, then cybernetics will enhance our ability to harness and manipulate fractional space in new and productive ways. While it is important not to be deterministic about the promise of new technology, it should not be feared either. Unlike Schafer and the World Soundscape Project, who seem to idealize pre-industrial sound environments, Schöffer recognizes the already pervasive presence of technology in society. In that sense, not only might "noisy" technologies like helicopters be welcomed for enhancing transportation flexibility, but for introducing a new sense of dynamism to the urban-sonic program.

3. **Leave room for people.** Despite the impressive, even phantasmagorical, nature of Schöffer's city, the focus never strays too far from human experience. While large-scale questions of agency are ultimately left unanswered in his work—questions, for instance, about people who do not want to live in a cybernetically controlled urban environment—small scale agency lies at the very center of his vision. Despite seeming highly planned, scripted, and centrally organized, ordinary people continue to have an active say in how the city sounds. There is no feedback without new input; and for that reason, the city's cybernetic infrastructure leaves open the possibility that anyone can participate in the artful construction of everyday life: twisting knobs, making new ambient sounds, taking note of the world as it can be heard.

Conclusion

I began this chapter by exploring the work of mid-20th century utopian urbanist Nicolas Schöffer. His 1969 book *La Ville Cybernétique* observed a general decline in contemporary society—the result of what he called "médiocrisation"—readily apparent

in manufactured goods, popular entertainment, and importantly, the sequestration of scientific knowledge. This decline had another important effect: a cultural preference for quantitative abundance, a desire for more things, whose accumulation has ultimately impeded our ability both to navigate the world and interact with it meaningfully. To remedy this problem, Schöffer proposed to remodel urban life completely.

Doing this would first require gaining control of fractional space—the experiential and sensory textures—which would itself require adopting a topological view of the environment—one that subdivides ordinary experience into five areas: light, climate, sound, weather, and air. In doing so, Schöffer believed it would be possible to restore balance to modern life, to elevate the human spirit, and to minimize disruptive "perturbations." Many interventions into fractional space would be executed by giant cybernetic towers. A number of prototypes, some of which predate the publication of *La Ville Cybernétique*, model what Schöffer had in mind. *Chronos 3*, built outside Liège during 1961, used environmental sensors to observe shifts in the urban ambience. It subsequently performed a visual and sonic spectacle, one that complemented the urban ambience as it could be seen and heard already. The program for *Chronos 3* included broadcasting randomized fragments from a piece of *musique concrète* called *Spatiodynamisme,* composed by electronic music composer Pierre Henry.

In later sections of this chapter, I explored several critical approaches to Schöffer's work. The first and most recent critique is exemplified by architectural historian Larry Busbea, who historicizes Schöffer's vision by situating it relative to other utopian visionaries of the period. Another critical approach analyses how the Cybernetic

City intersects with materialist critiques of capitalism. Jean Baudrillard, for instance, argues that Schöffer's vision legitimizes functionalism, and in doing so, becomes little more than an attempt to control "effects." A third line of critique can be developed from Jacques Attali's *Noise*. The Cybernetic City, I suggested, could be read as performing the third phase of sonic-social development, what Attali called "repeating."

Many of these critiques, however, seem to miss their mark. Schöffer, in fact, shared many of Baudrillard's and Attali's concerns—about consumerism, alienation, political power, and technology—which he lumped under the single term "médiocrisation." His plan for the Cybernetic City furthermore left ample space for human interactivity, cooperative social engagement, and collective art-making. And in that sense, it might be said to exemplify the "future" of music, what Attali rather optimistically termed "composing." As a form of social and political cartography, the Cybernetic City marks the return of "local knowledge, the insertion of culture into production and a general availability of new tools and instruments."[122]

It is clearly more difficult to propose a vision than to critique one, or to suggest it is possible to have one. Where scholars including Barry Truax and R. Murray Schafer have identified the need for acoustic design at the urban scale, none have offered a coherent vision for how and why the city might be literally composed. In that respect, the Cybernetic City, its towers especially, deserve a prominent place among contemporary music and sound studies scholarship. As a literary sound map, it not only raises important

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[122] Attali, *Noise,* 147.

questions about our relationship to sound, it theorizes in extraordinary detail how those relationships might be more effectively and dynamically sutured.

Conclusion

> The increasing mobility of music technologies, and the seemingly paradoxical emphasis on identity that surrounds analysis of musical consumption today, reveal how much the ongoing (re)shaping of listening habits is tied to our changing sense of location: where we are, where the music can take us, where we *belong*.
> —Jody Berland, "Locating Listening"

Concluding Thoughts

Over the last five chapters, I have sketched a critical and cultural history of sound maps: from their conceptual origins in architectural acoustics, to their wide-spread use in urban noise studies and music notation, and their influence on utopian urban planning. Perhaps it goes without saying that the definition of a "sound map" is necessarily broad and, like sound itself, slippery and ephemeral. And yet, this very slipperiness is what makes sound maps both versatile and widely useful. In general, sound maps can be understood as both physical objects and as a modality of engagement; a form of writing and a way of thinking; a means of describing sound while summoning it from invisibility. Still, much work remains to be done from this point. While the identification, analysis, and critique of sound maps could proceed in a number of new directions, in the last few pages of this dissertation, I wish to highlight a few that offer special promise and appeal.

1. Place-studies

As Jody Berland explained in her essay, "Locating Listening," the rise of portable media technologies has, over the last few decades, radically transformed how we relate to sound. Electronically-broadcast music—what Berland, following the World Soundscape Project, calls "schizophonic"—has altered not only the way in which identities are created, but, even more extensively, it has changed the nature of our interactions with the everyday environment and the economy more broadly. When we move, whether by car or

by foot, we bring our own, personalized and individualized sounds with us. And while music is commonly understood to articulate time, "which we then notice all the more," the space and spatiality of sound continues to pass virtually unnoticed.[1] As a result, she writes,

> [w]e don't place ourselves and the sounds in a spatially conceived map of synchronic and diachronic movement, evaluate from whence we are addressed, or consider how we are positioned by the instruments that bring that touching address to our ears. Thus we fail to apprehend the places we inhabit, not as visible points in physical space, but as the product of diverse and complex forces.[2]

Maps, it would seem, could play a significant role in changing (or at the very least, *challenging*) how we experience and define a sense of place. As a tool, they can be used to highlight complexity, to expose the social, cultural, and economic forces that give shape to identity. As Berland further explains, "the presence of Canadian music—whether white, Native, African, or Afro-American, or many others—on radio or television becomes the electronic equivalent of land claims on the ground."[3] Disentangling such territorial claims might very well become a primary function of sound maps. Much like the dynamic type discussed in Chapter 2, they could be used to trace the outline of "reproducible space"[4]—an especially important and relevant task today, as the geography of music continues to emerge as a serious area of research.

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[1] Jody Berland, "Locating Listening: Technological Space, Popular Music and Canadian Mediations," in *The Place of Music,* edited by Andrew Leyshon, David Matless, and George Revill (New York: The Guilford Press, 1998), 129.

[2] Ibid., 130.

[3] Ibid., 145.

[4] Ibid., 146.

2. Regulatory Verification

As discussed at length in Chapters 2 and 3, sound maps are commonly used as an instrument in government regulation—exemplified by the territory sound map type, and epitomized by Part 150 "Noise Exposure Maps." And yet, an important question remains unanswered: Do these maps bear any resemblance to what actual people experience, or do they represent nothing more than an already-institutionalized image of sound? Or, put in the words of Cornelius Cardew:[5] Whom do these maps serve? Even as this dissertation nears completion, questions like these leave me feeling apprehensive. Conceivably, though, sound maps could be turned back onto this problem. Much as I suggested at the end of Chapter 3, we could create a counter-discourse: new maps, especially dynamic and field maps, intended to verify and/or challenge the image of sound proposed by regulatory authorities like the FAA or DEFRA.

This is unquestionably an activist approach, one that requires opening the performative authority of the map to critique, while simultaneously relying on specialists to enroll the public in the process of mapping. The resulting counter-discourse would engage crucial questions: Do the contours shown on any particular NEM reflect noise exposures that can actually be heard? Does the DNL resemble anything that approximates the psychoacoustic conditions of everyday life? This information would then need to be buttressed by the observations of acculturated residents, much in the spirit of the World Soundscape Project. It may be discovered, for instance, that sound emanating from an airport is perceived psychoacoustically as much louder than empirical measurements would otherwise suggest—especially in cases where the surrounding environment is rural

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[5] Cornelius Cardew, *Stockhausen Serves Imperialism* (London: Latimer New Dimensions, 1974).

(or "hi-fi"). Conversely, airplane noise might be perceived as much quieter than empirically measured if a nearby highway has already, in effect, desensitized the public— who have already become accustomed to a higher level of ambient noise. In either case, these subtleties, these possible disjunctions between empirical fact and perceived reality, need focused attention.

The medium of the sound map I believe will play an increasingly important role in collating observations and directing further inquiry. Indeed, whatever specific methodology is used, the goal must be to find the coordinates of the "middle ground:" it must be to locate where lived reality intersects with sound estimates, decibel readings, the institutional power of the state, and the economic power of the global economy. Furthermore, and when necessary, it must be to challenge the performativity of maps, especially those which put the interests of non-living entities above the needs and wishes of human and non-human animals, whose health and well-being otherwise depend on clear and consistent access to the environment as audible.

3. Music notation

Earle Brown once wrote that "[we] have a 'crisis of consciousness,' and it has changed the nature of the artist's relationship to his work, and the relationship of the work to a performer, reader, viewer, or listener."[6] This "crisis," he said, was being driven as much by the evolution of philosophical and scientific thought as anything else. "What is being challenged" is the "concept of what is 'art' in music today, and this is rightfully a

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[6] Earle Brown, "The Notation and Performance of New Music," *Musical Quarterly* 72, no. 2 (1986): 197.

constantly recurring problem which indicates that the art is still vital and alive."[7] One way to tell whether music is "vital and alive," he suggests, is through examining its notational practices. Just as composers living centuries ago (though Brown mentions none by name) were concerned with how their music was written, Ives, Cowell, and other composers throughout the late 19th and early 20th centuries often sought innovative ways to notate their ideas. But today's composers, Brown writes, have become too heavily burdened by history. Worse still, they have increasingly erred in the direction of "discrete control," only to find themselves unable to achieve the precise results they are looking for.

Indeed, all too often, developments in musical notation are framed as though they reflect strictly musical problems. The appearance of sound maps as a notational form complicates this tendency, however, by linking new ways of writing sound with new ways of thinking about sound-space interactivity—with developments in science and philosophy that Brown mentions above. This, in turn, suggests two possible directions for composers and scholars of music. First, it suggests a return to notational experimentation. Many new and ambitious forms, including what Erhard Karkoschka has called "musical graphics,"[8] were in large part abandoned at the end of the 20th century as composers and audiences returned to more conservative ways of writing music. By articulating un- and under-appreciated conceptual linkages, sound maps challenge us to try new things, to develop new forms of notation that to reflect the current state of scientific, cultural, and artistic discourse.

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[7] Ibid., 180.

[8] Erhard Karkoschka, *Notation in New Music: A Critical Guide to Interpretation and Realisation,* trans. Ruth Koenig (New York and Washington: Praeger Publishers, 1972), 77.

Second, it suggests scholars should begin to theorize musical notation in terms that are much broader than those they have become accustomed to. As I outlined in Chapter 4, notational practices should not be considered apart from culture and society: as it is written and conceived, music unavoidably contributes to and participates in a dialog with politics, public discourse, and even attitudes about the environment. Sound maps, then, are just one of many "unusual" and "unorthodox" notational practices worthy of broader contextualization. Now, other varieties deserve similar treatment. In addition to developments in architectural acoustics, it is conceivable that cold war game theory, theories about the "selfish gene," and radical social experiments of the 1960s and 70s (including "hippie" communes) could and should be linked to mid-century notational practice.

Finally, whatever the future study of sound maps may bring, I hope this dissertation has provided a useful starting point, a few places to begin thinking about and engaging with the environment as already and richly sounded.

Appendix: Figures
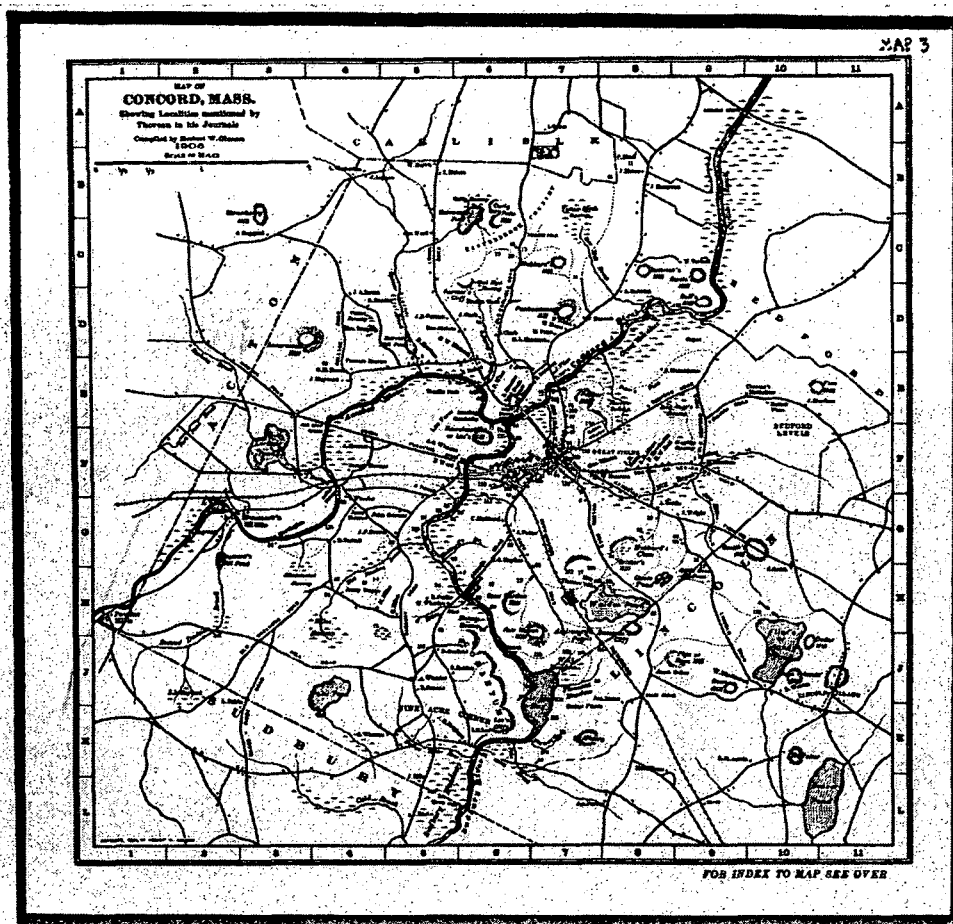
Figure 0-1. Map of Concord, MA included with the score for *Song Books, Volume I* by John Cage. The accompanying text instructs performers to draw a line between two places on the map and to interpret the resulting trace as a melody. The words to be sung with the melody come from a poem by Henry David Thoreau. (Image from: John Cage, *Song Books Song Books, Volume I: Solos for Voice: 3-58* [New York and London: C.F. Peters, 1970].)
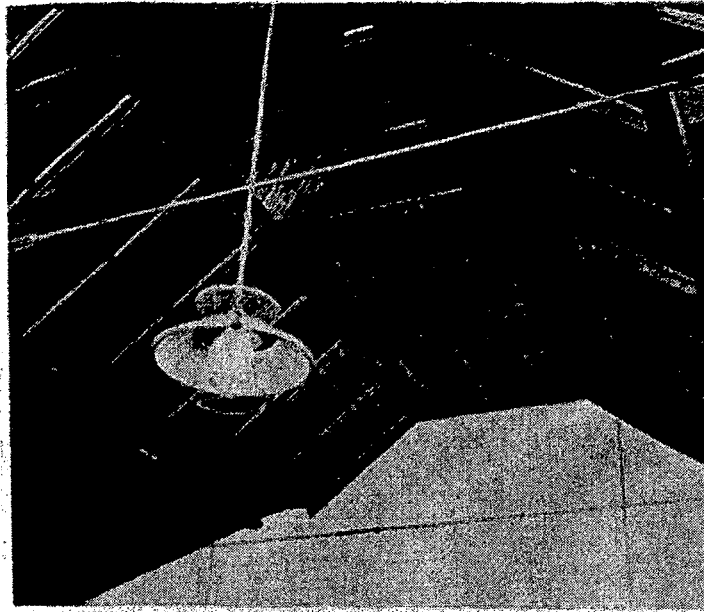
Figure 1-1. A superstitious solution to the problem of unwanted reverberation: suspending long lengths of metal wire from one end of a room to the other, just below the ceiling. The belief that strings would mitigate poor acoustics was dispelled by the research of Wallace Sabine. (Image from: Wallace Clement Sabine, *Collected Papers on Acoustics* [Cambridge, MA: Harvard University Press, 1922], 133.)
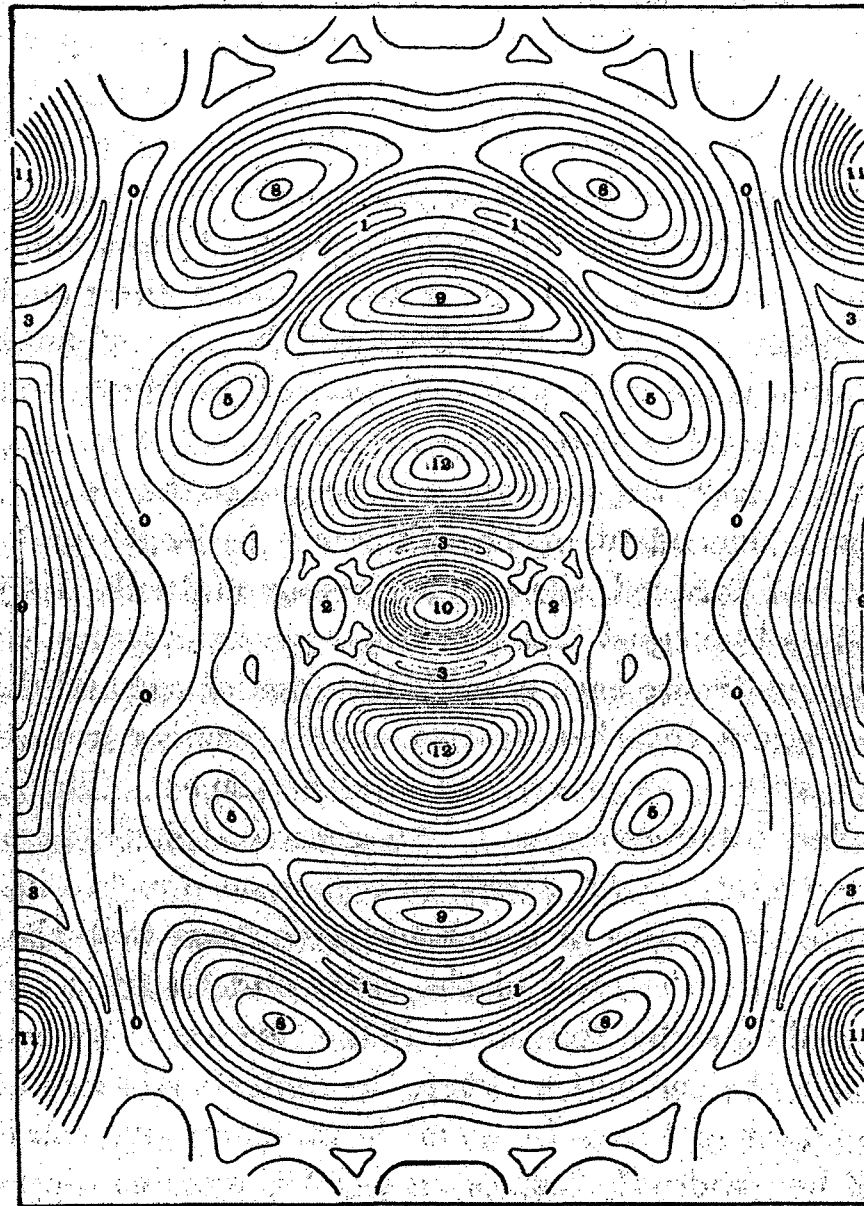
Figure 1-2. A sound map showing intensity contours. This image, created by Wallace Sabine, shows observed variations in a rectangular room with a barrel-shaped ceiling. The varying intensity levels shown on this map, for instance, 10 in the center and 11 in the corners, are relative and not determined by an "objective" scale. (Image from: Wallace Clement Sabine, *Collected Papers on Acoustics* [Cambridge, MA: Harvard University Press, 1922], 152.)
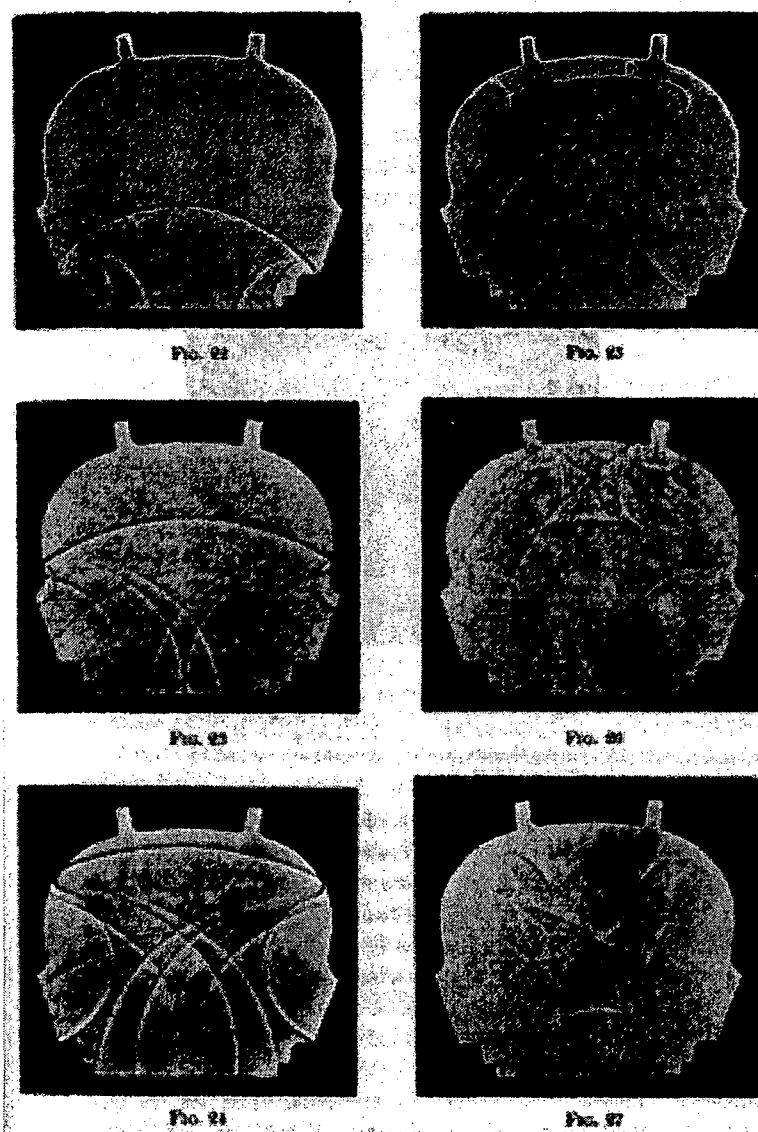
Figure 1-3. A succession of photographs made by Wallace Sabine using *schlieren-Methode* photography. These image show the movement, reflection, and dispersion of a single pulsed wave. The image sequence proceeds from the top left to the bottom right. (Image from: Wallace Clement Sabine, *Collected Papers on Acoustics* [Cambridge, MA: Harvard University Press, 1922], 185.)
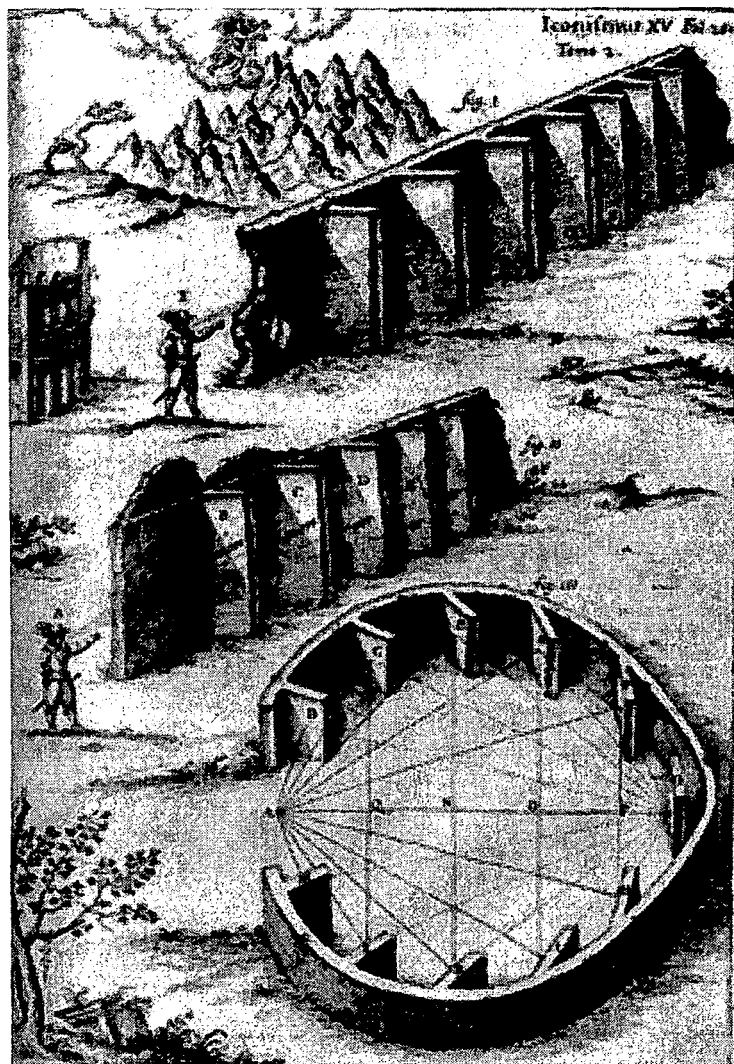
Figure 1-4. In this image, Kircher shows how "a series of equally spaced walls, or towers, will reflect the voice in a multiple echo." (Joscelyn Godwin, *Athanasius Kircher's Theatre of the World: The Life and Work of the Last Man to Search for Universal Knowledge* [Rochester, VT: Inner Traditions, 2009],164) The lines have a double function: not only do they demonstrate the specific acoustic effect in question, but are speculative stand-ins for sound as it encounters each new reflective surface. It is, in that respect, an inaccurate and misleading image, since sound does not move like a ray, but as shown by Sabine, like a wave. (Image from: Athananasius Kircher, *Musurgia Universalis* [Rome, 1650], 246.)
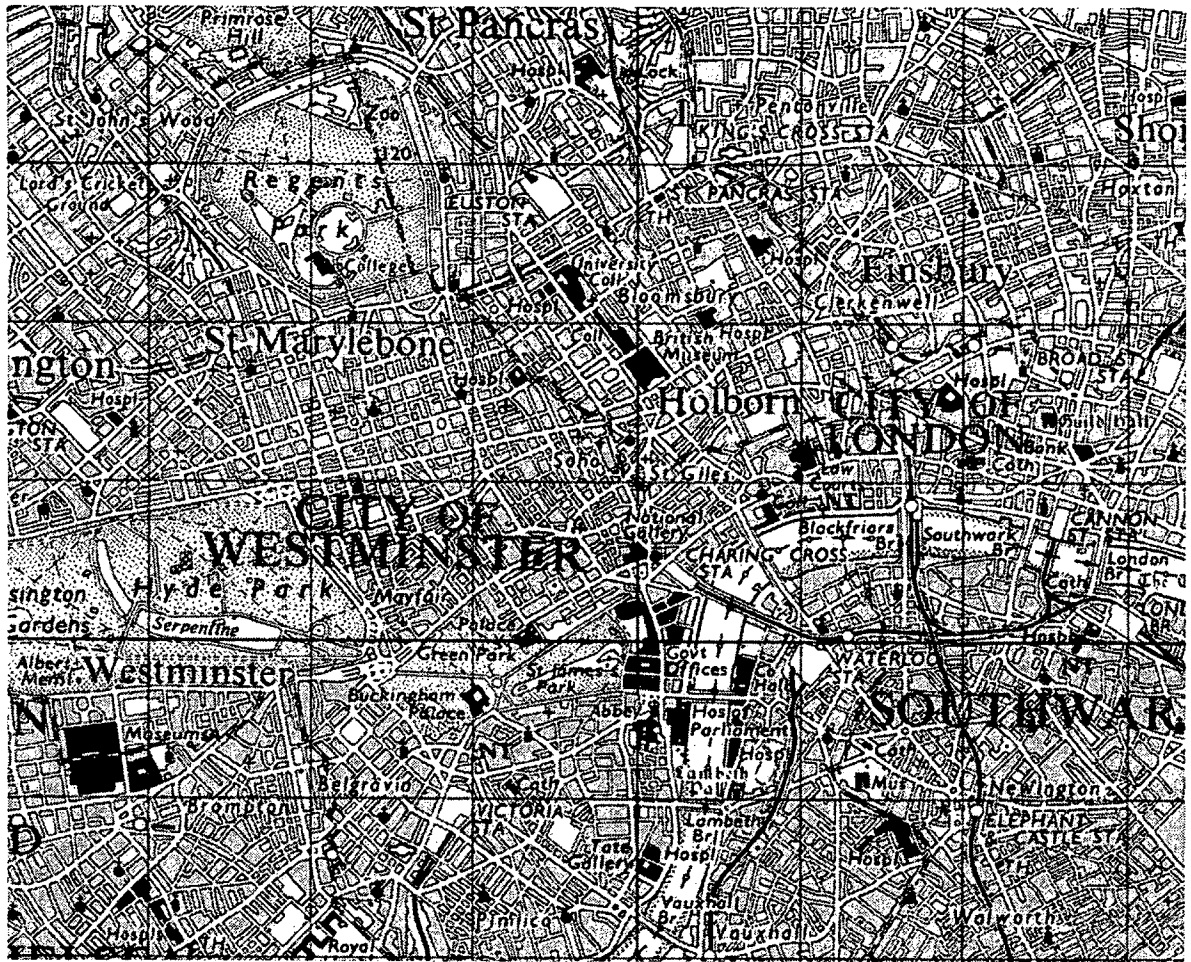
Figure 2-1. Detail view of a map published in the *London Noise Survey* showing the area covered during the objective survey. While this image depicts reference lines, this grid was not used to frame the scope and aims of the survey itself. (Image from: Building Research Station, Ministry of Public Building and Works, *London Noise Survey,* Her Majesty's Stationery Office: London, 1968.)

Figure 2-2. Initial report form published in the *London Noise Survey*, showing the location of the recording van, a description of the local environment, and other details, such as weather conditions. (Image from: Building Research Station, Ministry of Public Building and Works, *London Noise Survey* [Her Majesty's Stationery Office: London, 1968], 2.)
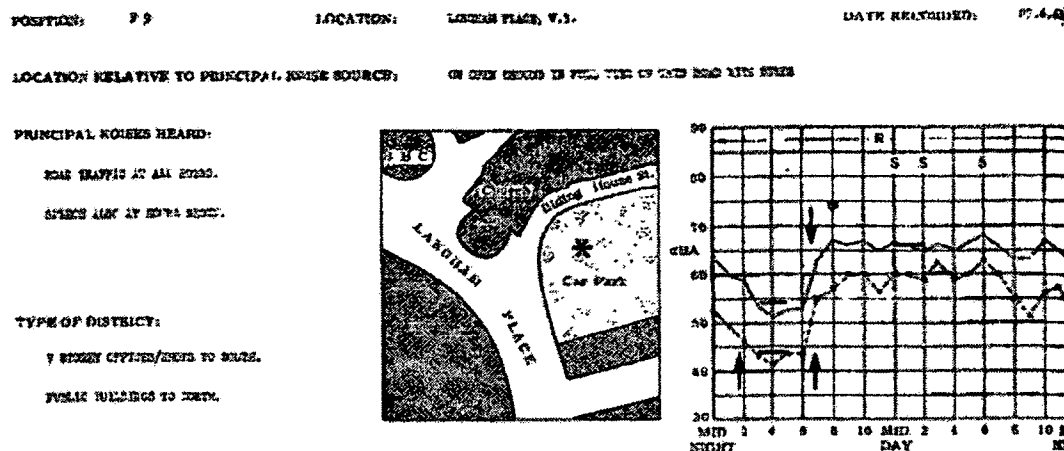
Figure 2-3. Published version of Figure 2-2 above. The asterisk marks the location of the recording van. Principal noises heard include "road traffic," and the graph to the right shows the average high and low decibel readings for an average day of the week. (Image from: Building Research Station, Ministry of Public Building and Works, *London Noise Survey* [Her Majesty's Stationery Office: London, 1968], 44.)
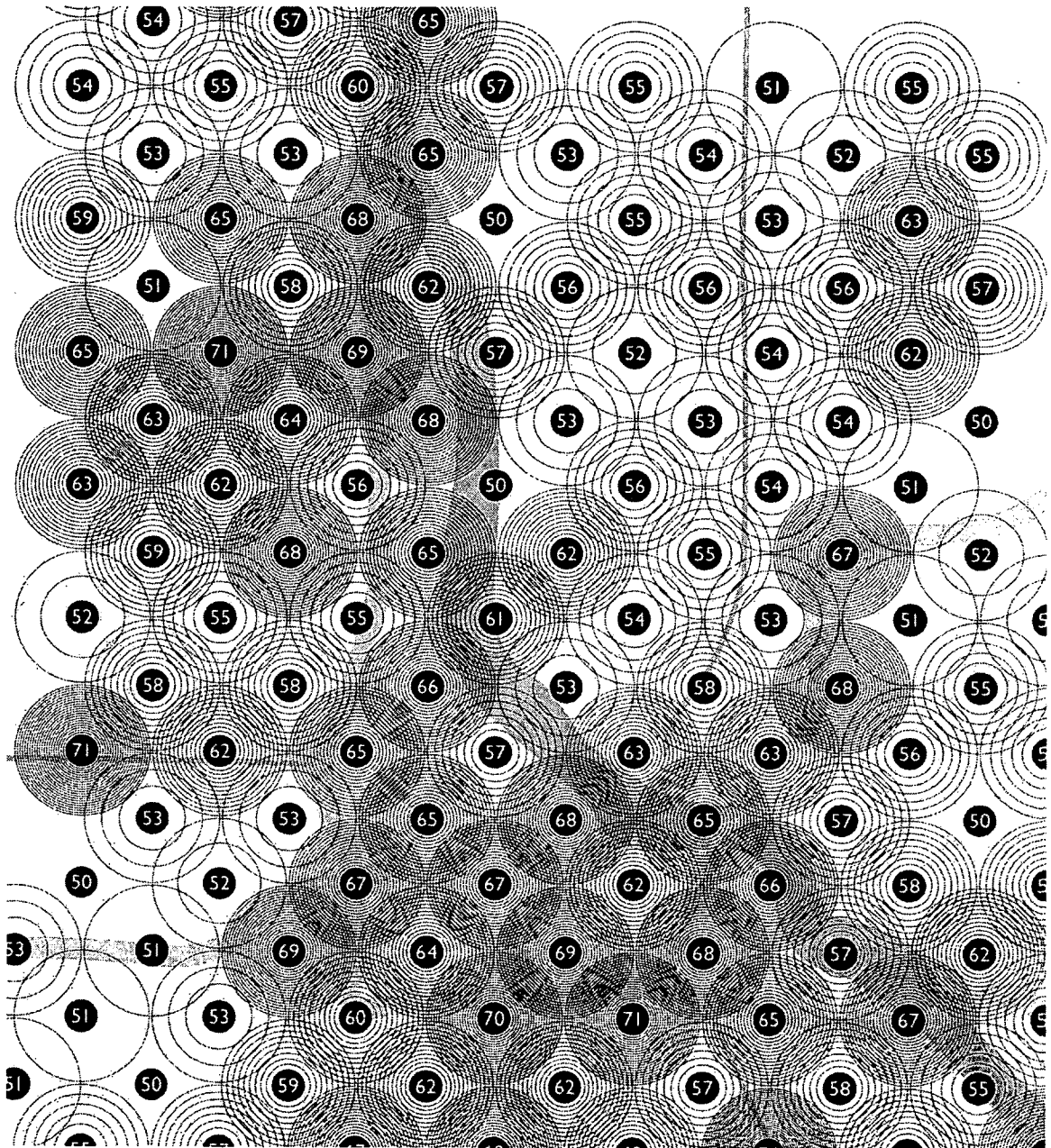
Figure 2-4. Detail of grid map, "466 Decibel Readings," designed by Rachel Thompson and Jonathan Zorn. (Image from: Jonathan Zorn, Rachel Thompson, et al, *466 Decibel Readings and 50 Sound Stories,* map created for the Twin Cities Design Festival in 2003, organized by the Walker Art Museum; copy held in the author's possession.)
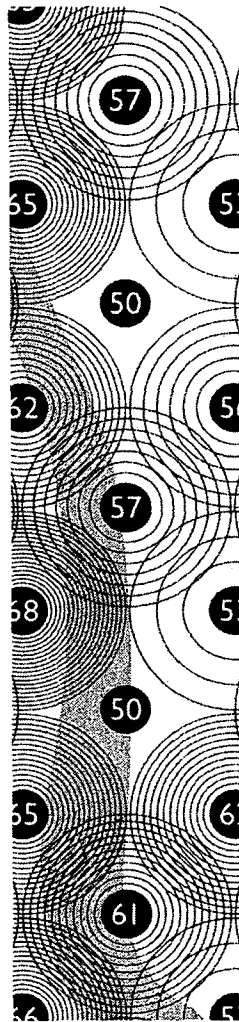
Figure 2-5. Detail of Figure 2-4 showing decibel readings with a corresponding number of concentric circles. (Image from: Jonathan Zorn, Rachel Thompson, et al, *466 Decibel Readings and 50 Sound Stories,* map created for the Twin Cities Design Festival in 2003, organized by the Walker Art Museum. Copy held in the author's possession.)

SOUNDMARKS

PT. ATKINSON DIAPHONE

OCEAN-GOING VESSELS SIGNAL HERE

CALAMITY PT. FOG HORN

PROSPECT PT. FOG HORN

BROCKTON PT. FOG HORN

NINE O'CLOCK GUN

O CANADA HORN

HOLY ROSARY CATHEDRAL
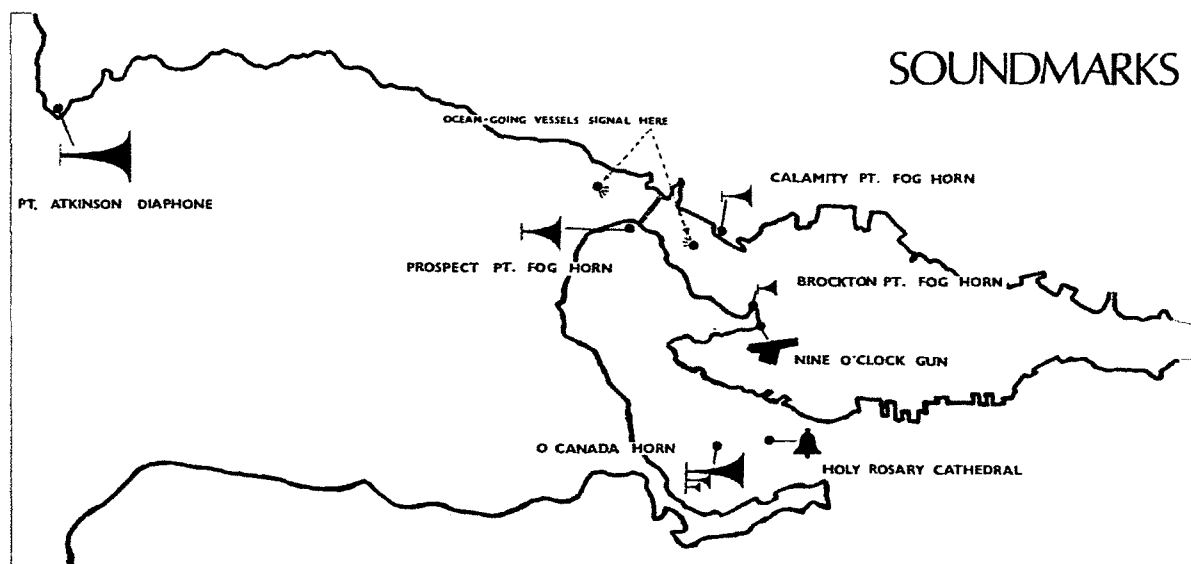
Figure 2-6. Field map of Vancouver showing "soundmarks" in the harbor. (Image from: R. Murray Schafer, ed., *The Vancouver Soundscape* [Vancouver: A.R.C. Publications, 1978], 36.)
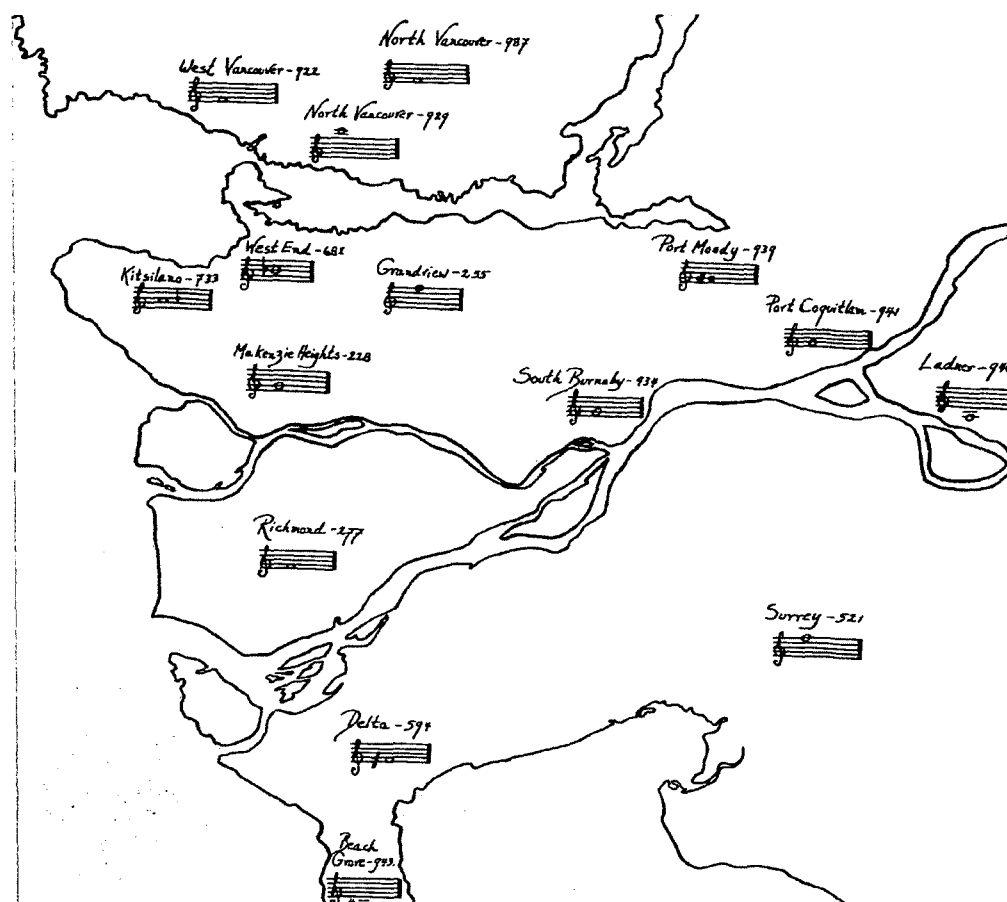
Figure 2-7. Map showing the pitch of various telephone dial tones in Vancouver. (Image from: R. Murray Schafer, ed., *The Vancouver Soundscape* [Vancouver: A.R.C. Publications, 1978], 43.)
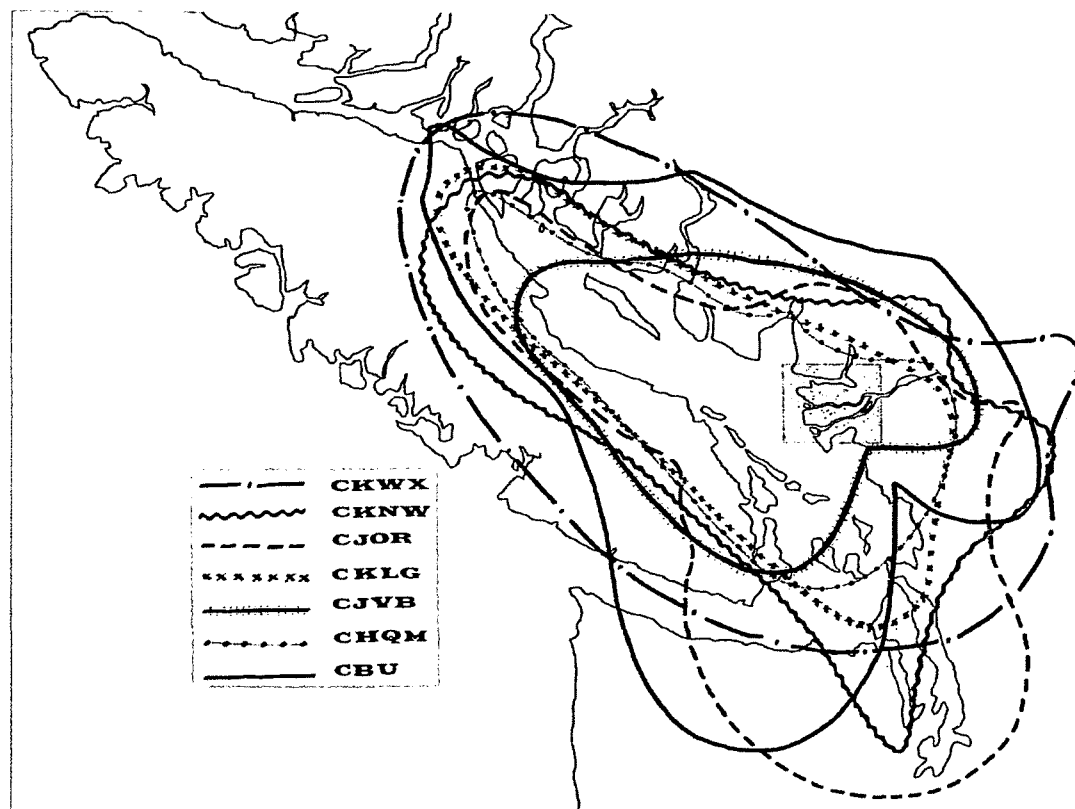
Figure 2-8. Map showing the broadcast range of different radio stations in the Vancouver area. (Image from: R. Murray Schafer, ed., *The Vancouver Soundscape* [Vancouver: A.R.C. Publications, 1978], 40.)
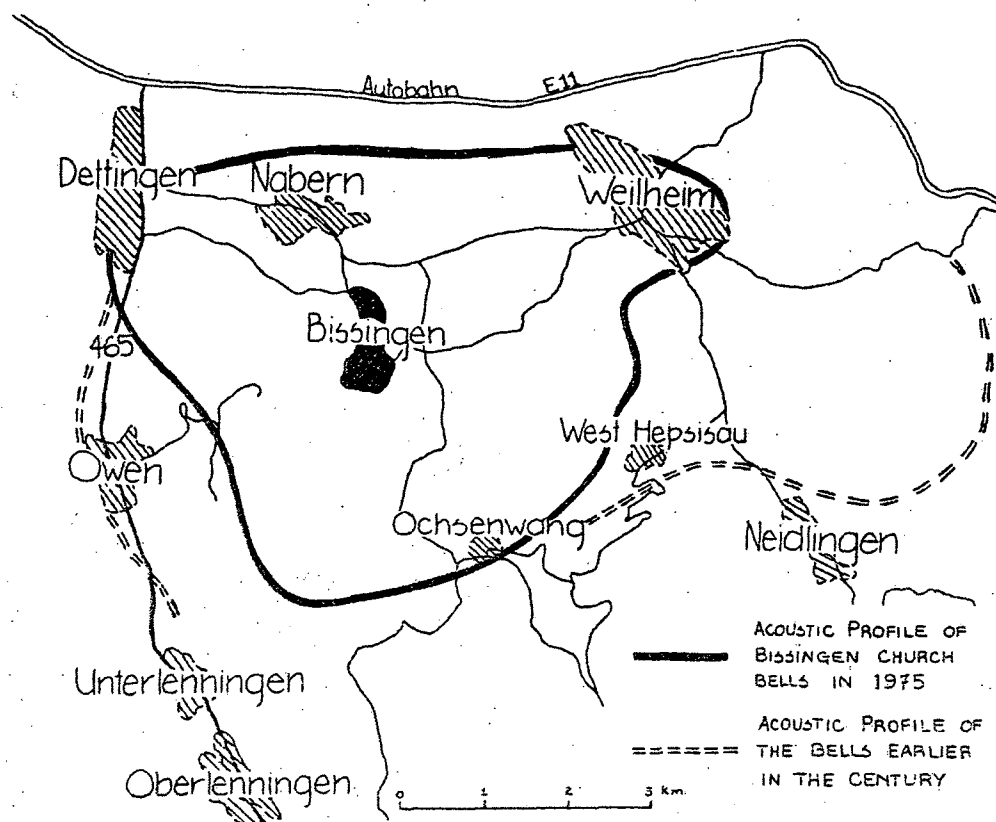
Figure 2-9. Map of Bissingen, Germany showing the psychoacoustic profile of the village church's bell. (Image from: R. Murray Schafer, ed., *Five Village Soundscapes* [Vancouver: A.R.C. Publications, 1977], 53.)
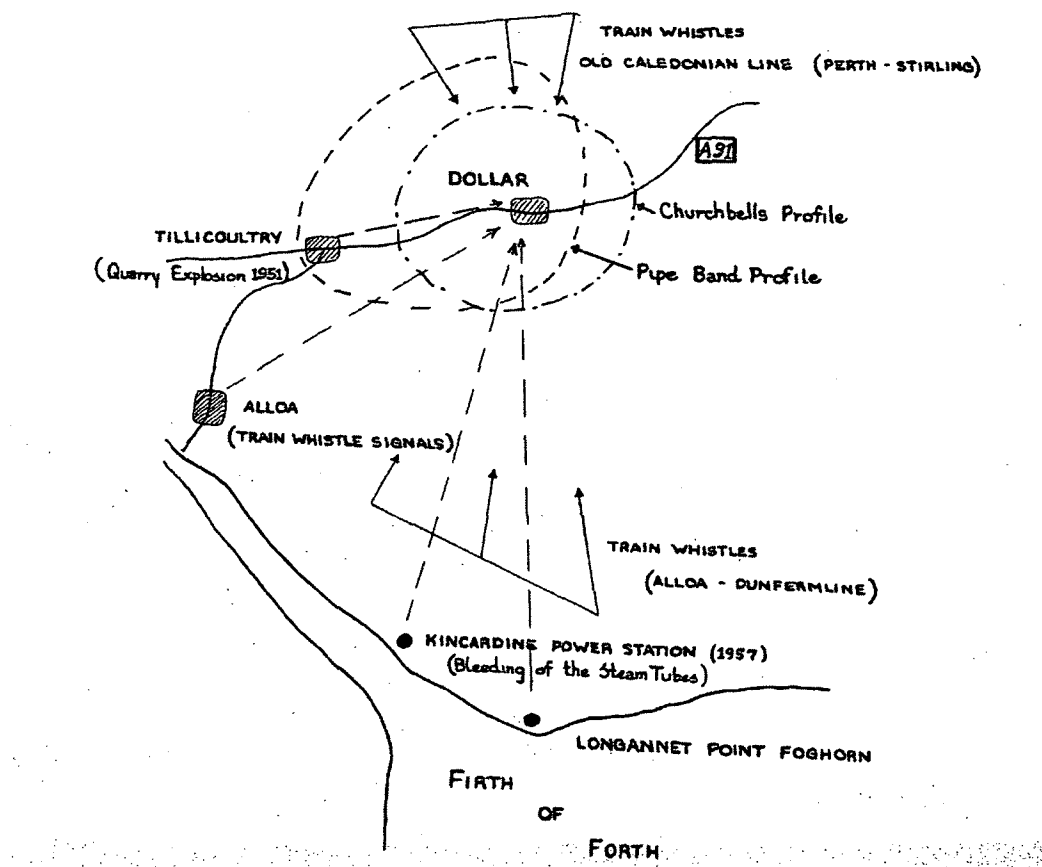
Figure 2-10. Map showing the aural composition of Dollar, Scotland. (Image from: R. Murray Schafer, ed., *Five Village Soundscapes* [Vancouver: A.R.C. Publications, 1977], 57.)
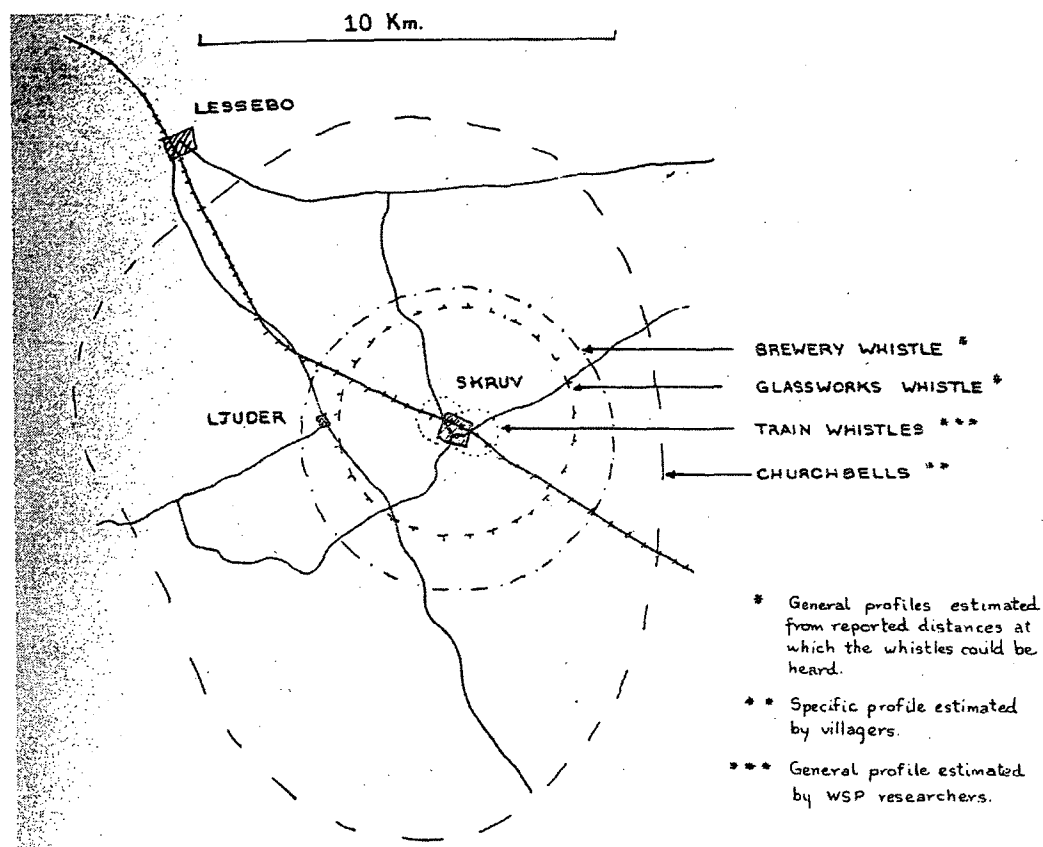
Figure 2-11. Map showing the "physical areas encompassed by the signal sounds of Skruv." (Image from: R. Murray Schafer, ed., *Five Village Soundscapes* [Vancouver: A.R.C. Publications, 1977], 51.)
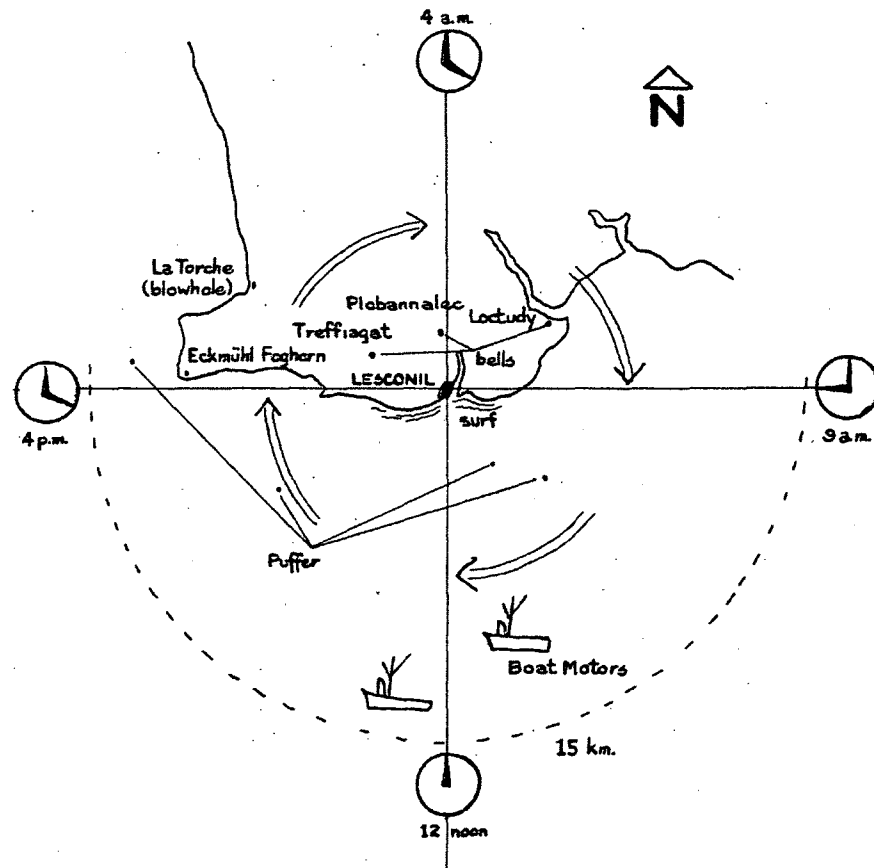
Figure 2-12. "Solar Wind Cycle and Sound" map of Lesconil, France. (R. Murray Schafer, ed., *Five Village Soundscapes* [Vancouver: A.R.C. Publications, 1977], 55.)
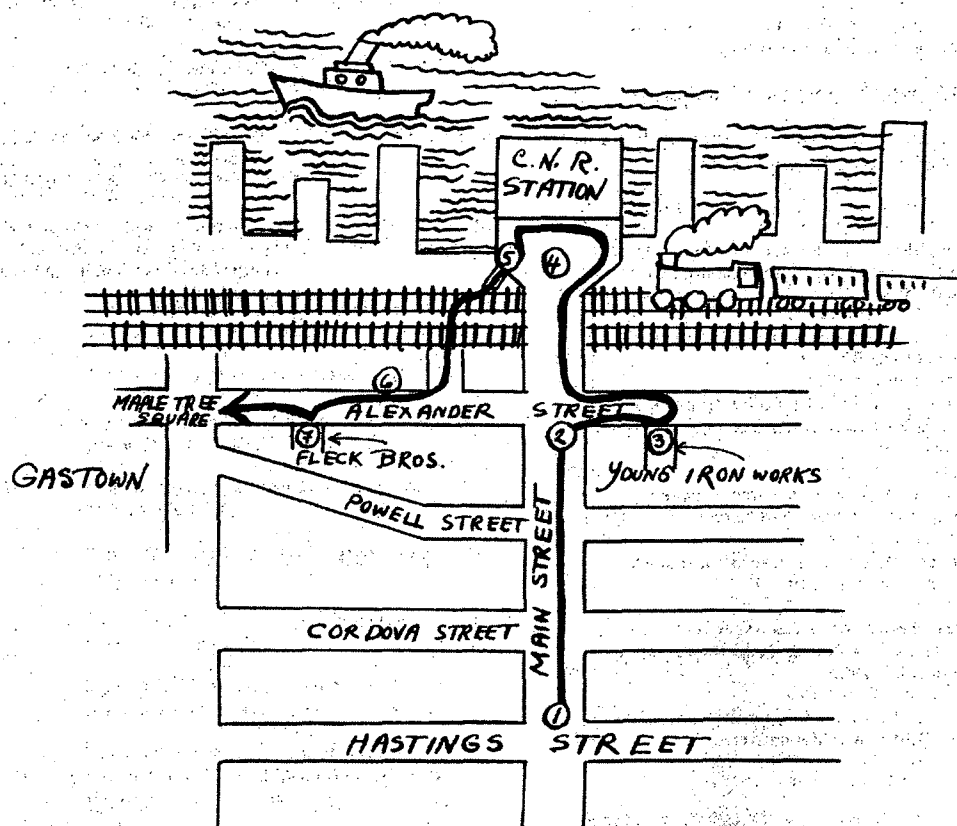
Figure 2-13. Soundwalk map showing a sequence of points and a path to be followed. (Image from: R. Murray Schafer, ed., *The Vancouver Soundscape* [Vancouver: A.R.C. Publications, 1978], 70.)

Figure 2-14. Detail of a soundwalk map by Hildegard Westerkamp, titled "A Soundwalk in Queen Elizabeth Park in Vancouver." (Image from: Hildegard Westerkamp, "Soundwalking," *Sound Heritage* 3, no. 4 [1974], http://www.sfu.ca/%7Ewesterka/ writings%20page/articles%20pages/soundwalking.html [accessed 12 May 2010].)
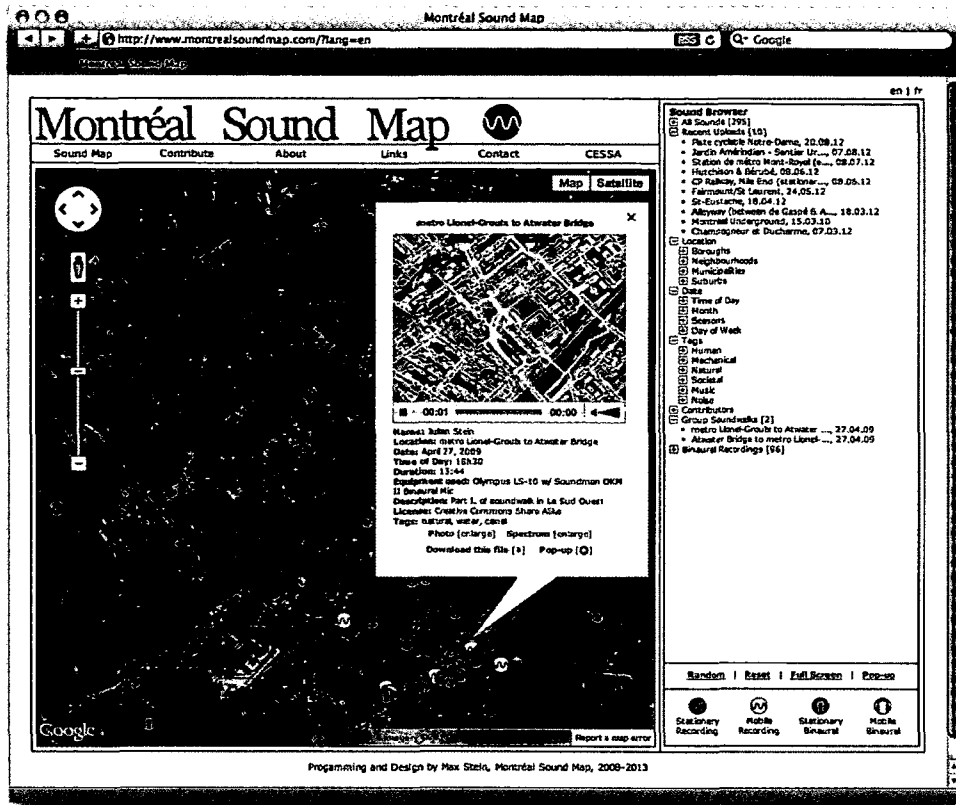
Figure 2-15. Screenshot of the "Montréal Sound Map" showing a pre-recorded soundwalk in the pop-up. (Image from: "Montréal Sound Map," http://cessa.music.concordia.ca/soundmap/en/ [accessed 1 February 2010].)
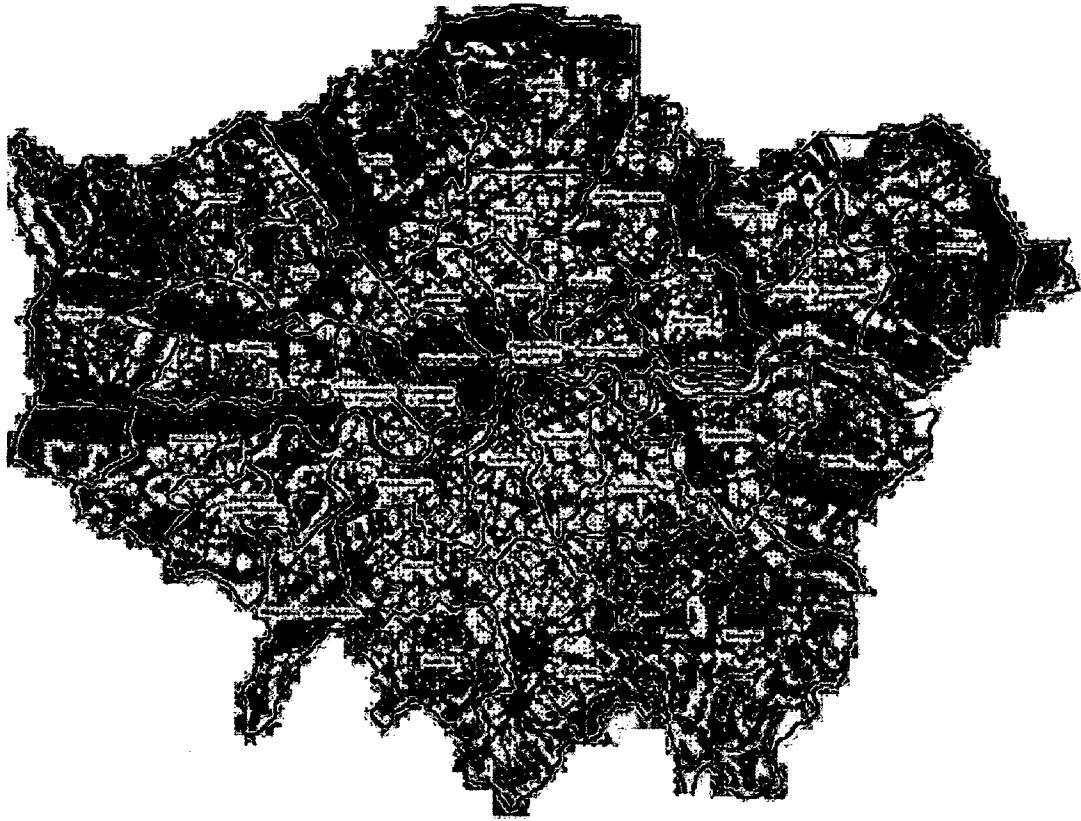
Figure 2-16. Composite image of DEFRA's London noise map. (Image from: "NoiseMap: Environmental Noise Mapping Software," http://londonnoisemap.com/ [accessed 6 February 2013].)

Figure 2-17A. Screenshot of DEFRA's online noise map showing the area around Hyde Park in London. Note that human pathways, including those through Hyde Park, are marked gray, indicating they are "unmapped." (Image from: "Noise Mapping England." Department for Environment Food and Rural Affairs. http://services.defra.gov.uk/wps/portal/noise [accessed 6 Feburary 2013).)

Figure 2-17B. Detail of Simon Elvin's "Silent London" showing the same area detailed in Figure 2-16A. Reliance on DEFRA's visualization yielded some unusual results: walkways, even through parks, were rendered the same color as the loudest of urban roads. (Image from: Simon Elvins, "Silent London," digital reproduction of a blind embossed etching, http://www.simonelvins.com/silent_london.html [accessed 6 February 2013].)
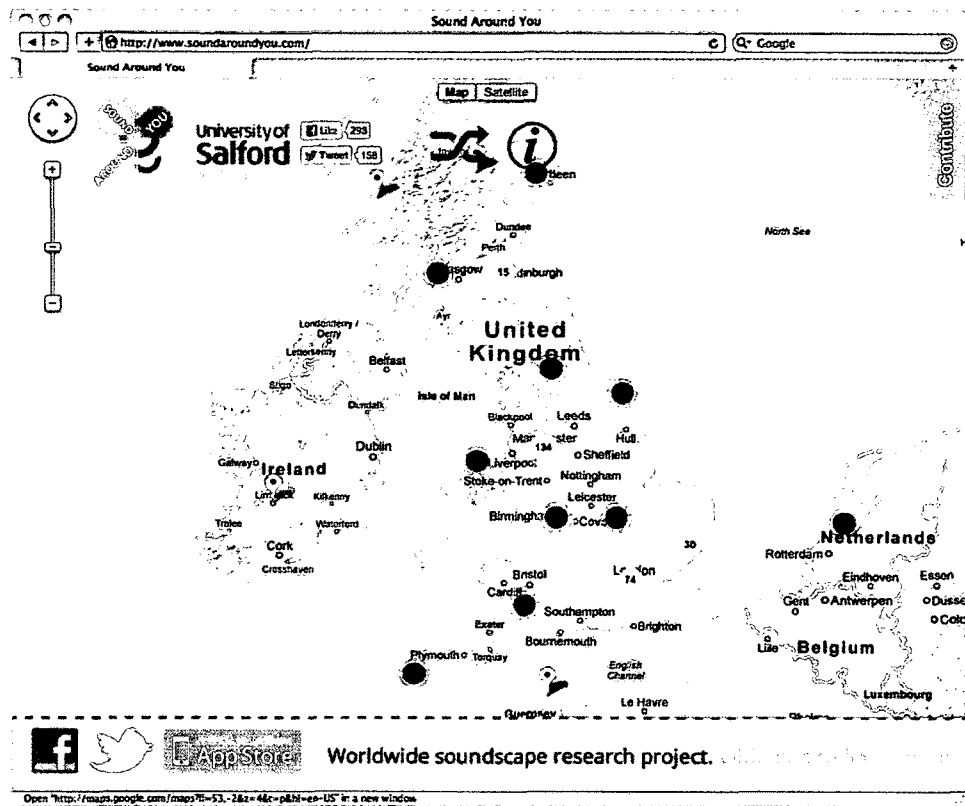
Figure 2-18. Screenshot of "Sounds Around You," a dynamic sound map website operated by the University of Salford. (Image from: "How to Get Involved," *Sounds Around You,* http://www.soundaroundyou.com [accessed 10 November 2013].)
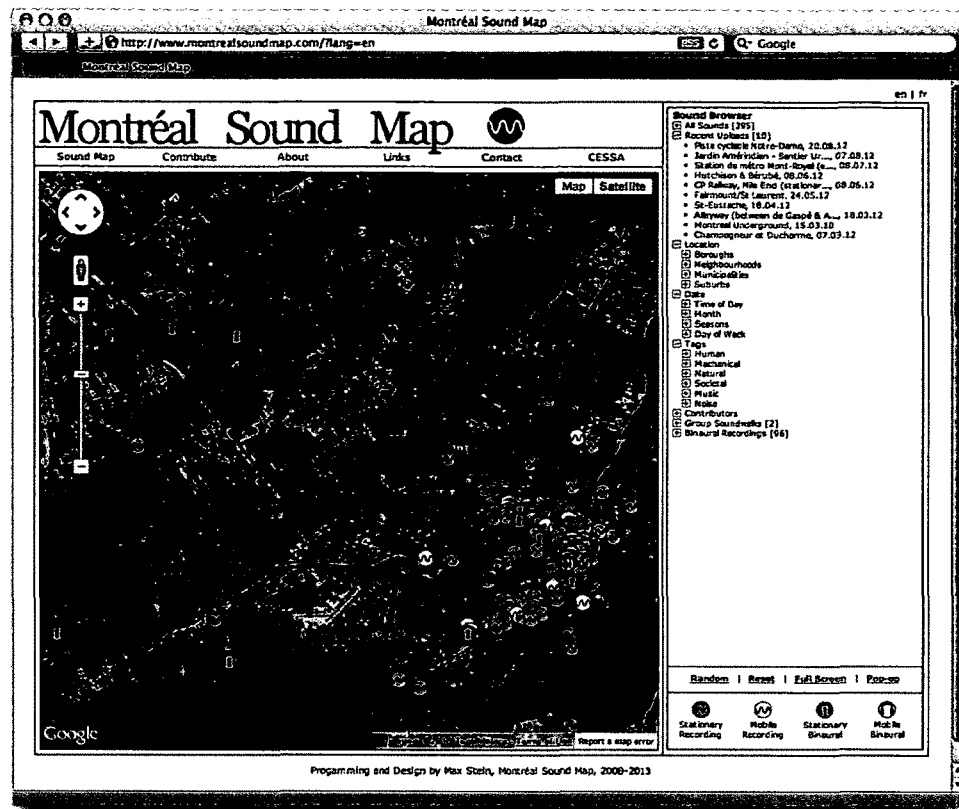
Figure 2-19. Screenshot of the "Montréal Sound Map," showing tagged and labeled sound categories in the right hand column. (Image from: "Montréal Sound Map," http://cessa.music.concordia.ca/soundmap/en/ [accessed 17 January 2011].)
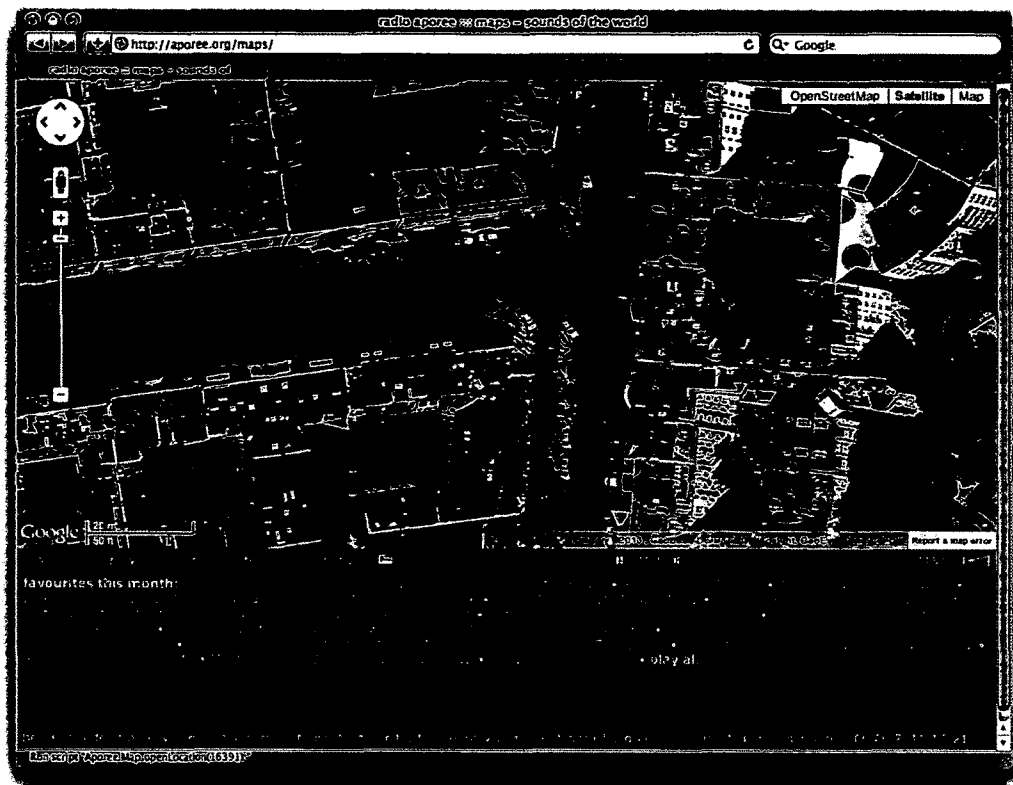
Figure 2-20. Screenshot of the sound map organized by "radio aporee." Red dots indicate embedded sound files. (Image from: *Radio aporee, http://aporee.org/maps/info* [accessed 10 January 2013].)
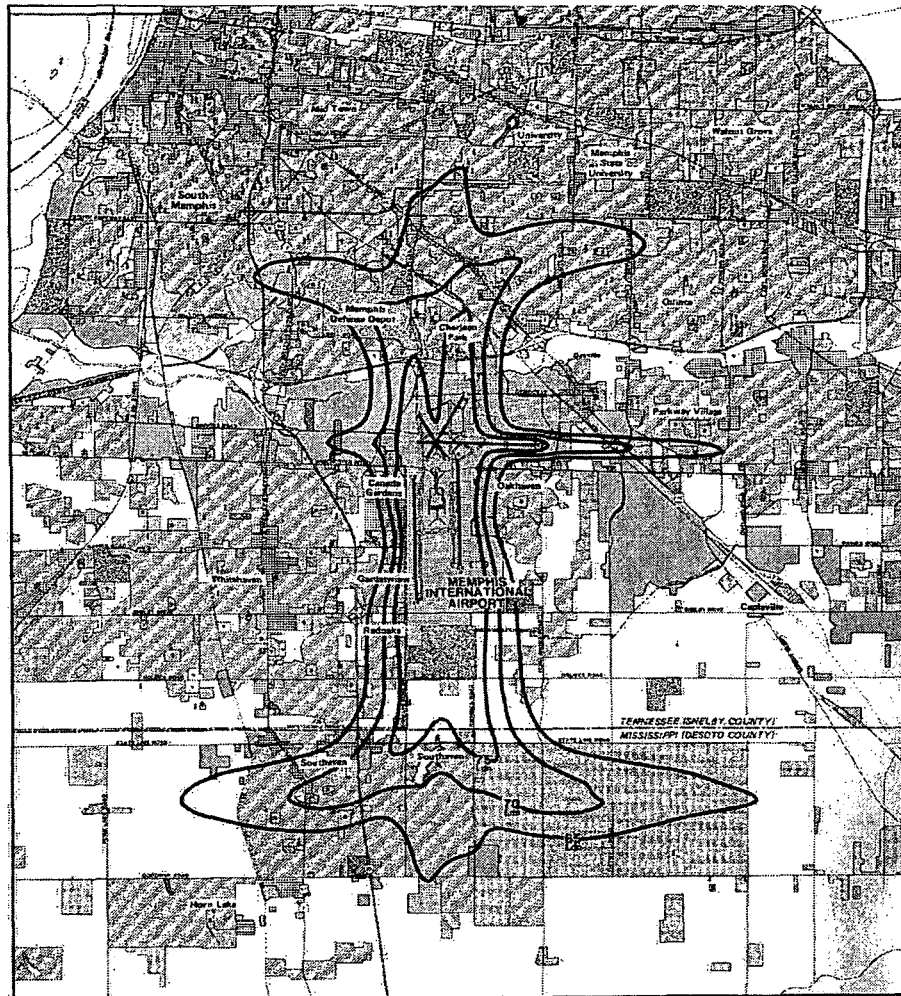
Figure 3-1. "Noise Exposure Map" of the Memphis International Airport showing noise contours as stipulated by CFR 49, Part 150. (Image from: PEAT Marwick, Master Plan and Noise Compatability Program, Memphis International Airport, "Noise Exposure Map: 1985 Operations," public document available through the Memphis International Airport Authority; report in possession of the author.)
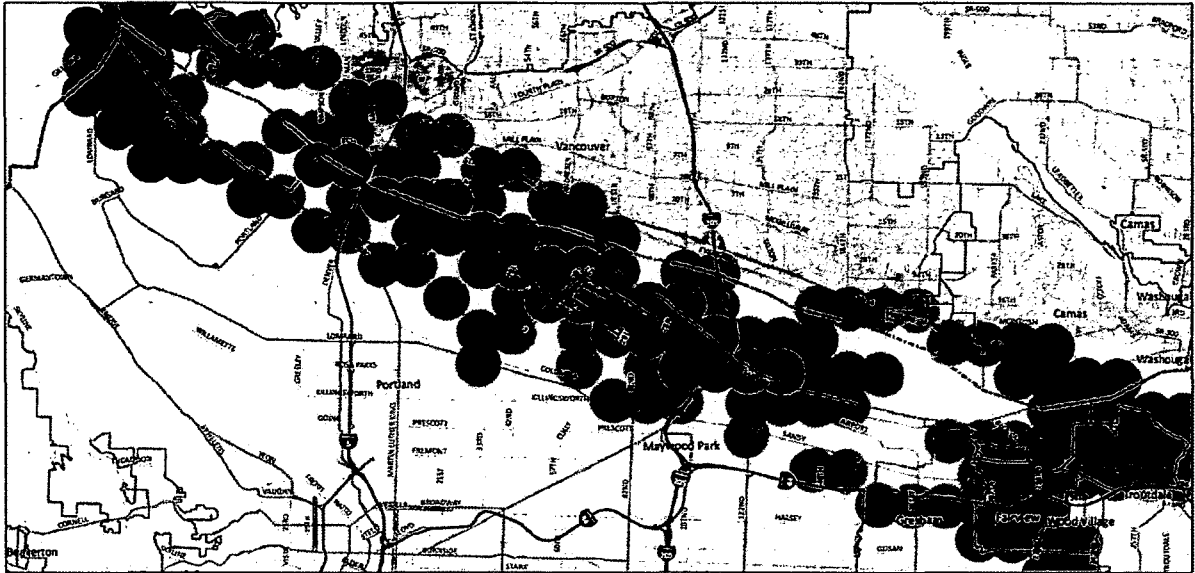
Figure 3-2. Supplementary NEM showing the statistical likelihood that sound above 65dB will be heard at any moment in the area surrounding the Portland International Airport. Red indicates a high probability while green indicates low. (Image from: Jacobs Consultancy, FAR Part 150 Noise Exposure Map Update, Portland International Airport, Prepared for the Port of Portland, Portland, OR, Appendix D, Figure D-3, July 2010; report in possession of the author.)
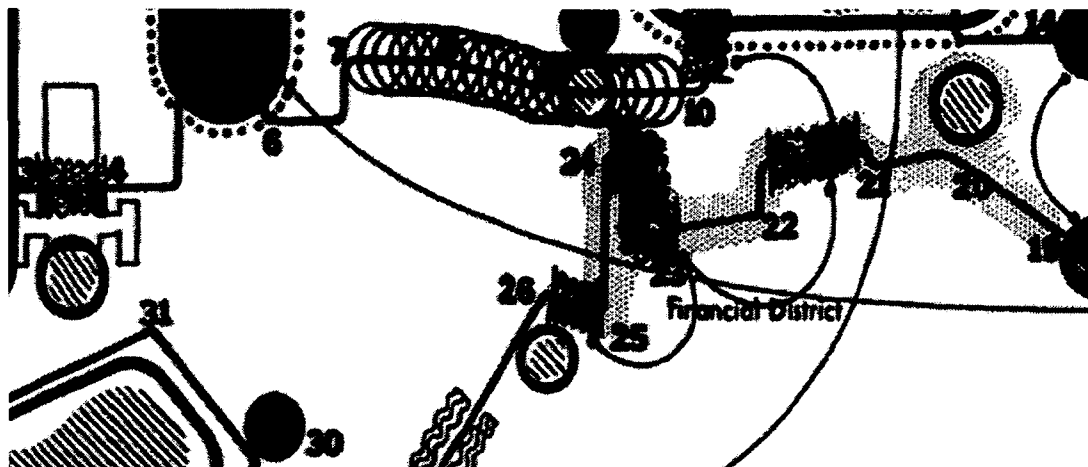
Figure 3-3. Detail of Michael Southworth's map of Boston showing different neighborhoods coded according to their aural identity. (Image from: Michael Southworth, "The Sonic Environment of Cities," *Environment and Behavior* 1, no. 1 [1969], 55.)

Set up: It is suggested that the instruments be set up as shown below:
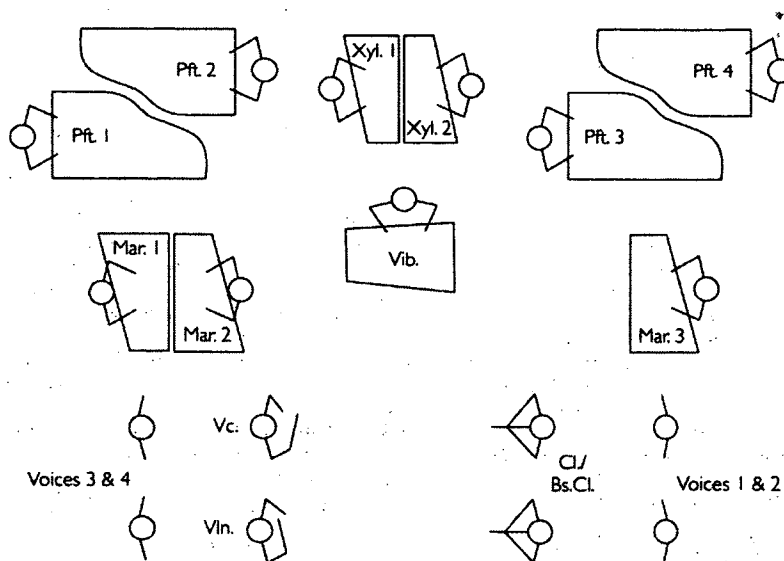
Figure 4-1. Diagram included with *Music for 18 Musicians.* (Image from: Steve Reich, *Music for 18 Musicians* [New York: Boosey and Hawkes, 2000].)

Arrangement of Instruments and Amplification Equipment
The electric organs, maracas, amplifiers and loudspeakers should be set up as shown in the drawing and photograph below:
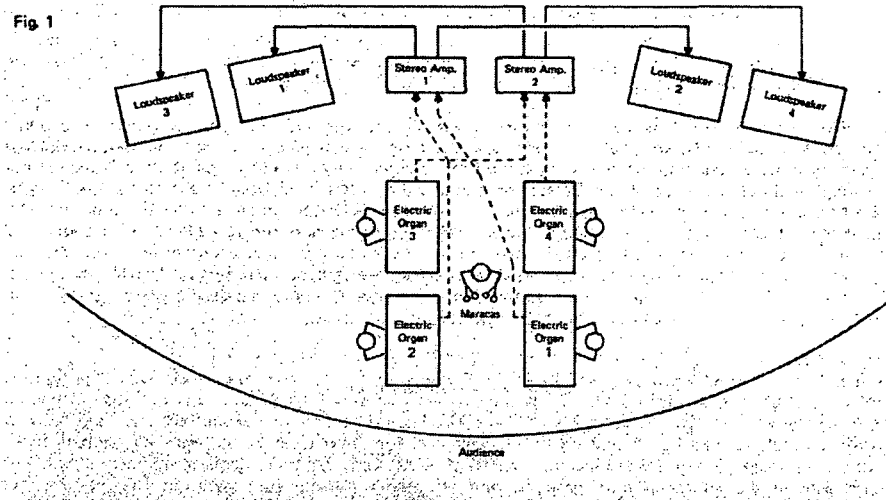
Figure 4-2. Diagram included with *4 Organs*. (Image from: Steve Reich, *Four Organs* [London: Universal Edition, 1980].)
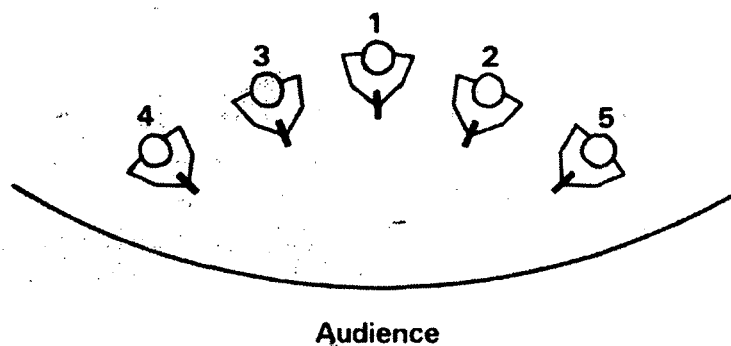
Figure 4-3. Diagram included with *Music for Pieces of Wood*. (Image from: Steve Reich, *Music for Pieces of Wood* [London: Universal Edition, 1980].)
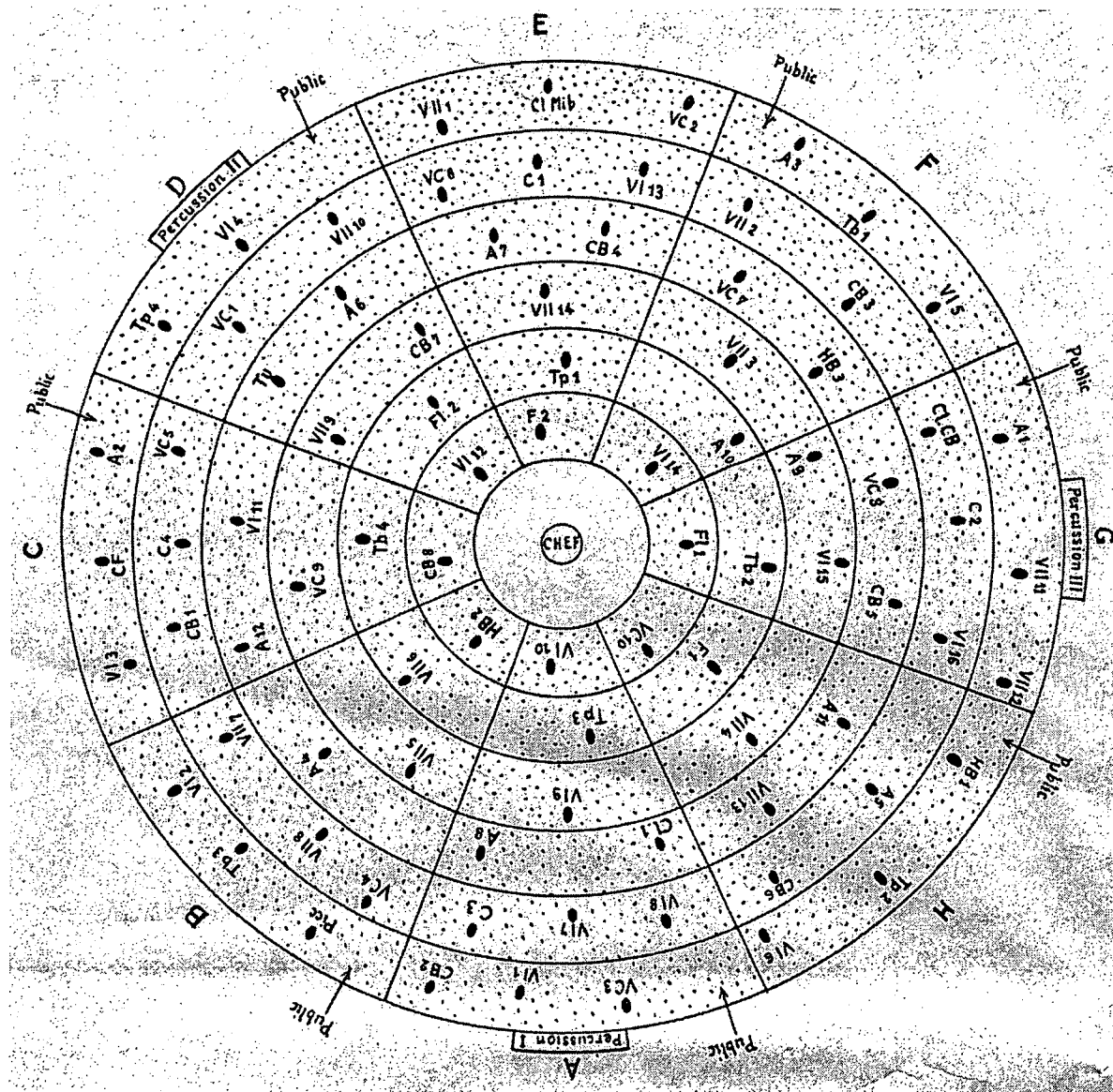
Figure 4-4. Spatial diagram included with *Terretektorh*. (Image from: Iannis Xenakis, *Terretektorh: Pour Orchestre* [Paris: Editions Salabert, 1969].)

Figure 4-5A. Spatial diagram showing "Disposition A" for the performance of *Polytope*. (Image from: Iannis Xenakis, *Polytope* [London: Boosey and Hawkes, 1969].)

Figure 4-5B. Spatial diagram for "Disposition B" for the performance of *Polytope*. (Image from: Iannis Xenakis, *Polytope* [London: Boosey and Hawkes, 1969].)
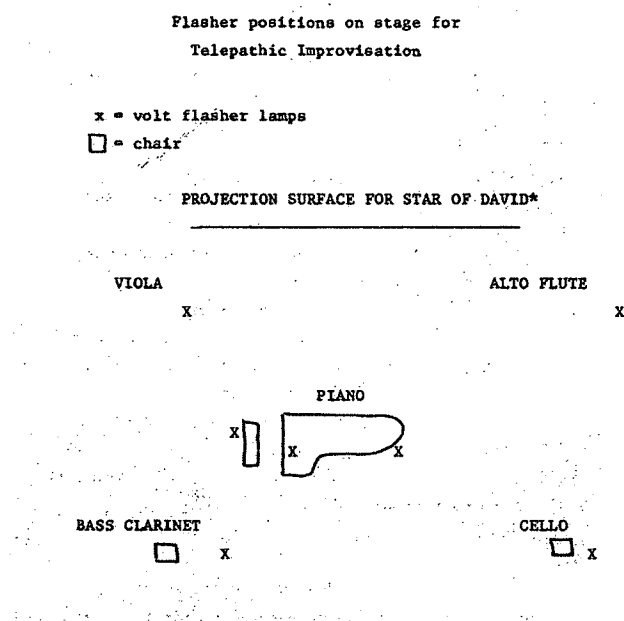
Figure 4-6. Spatial diagram showing required components for a performance of *Aeolian Partitions*. (Image from: Pauline Oliveros, *Aeolian Partitions* [Brunswick, ME: Bowdoin College Music Press, 1970].)
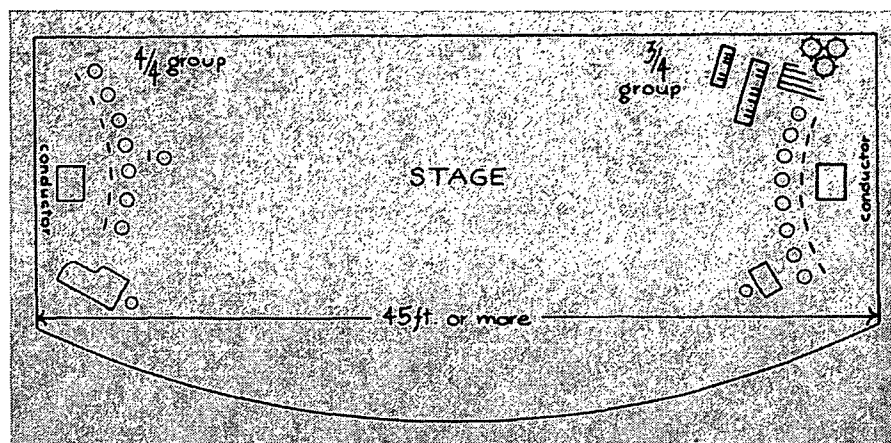
Figure 4-7A. Spatial diagram showing the approved distribution of performers in Henry Brant's *Verticals Ascending.* (Image from: Henry Brant, *Verticals Ascending after the Rodia Towers* [New York: MCA Music, 1969].)
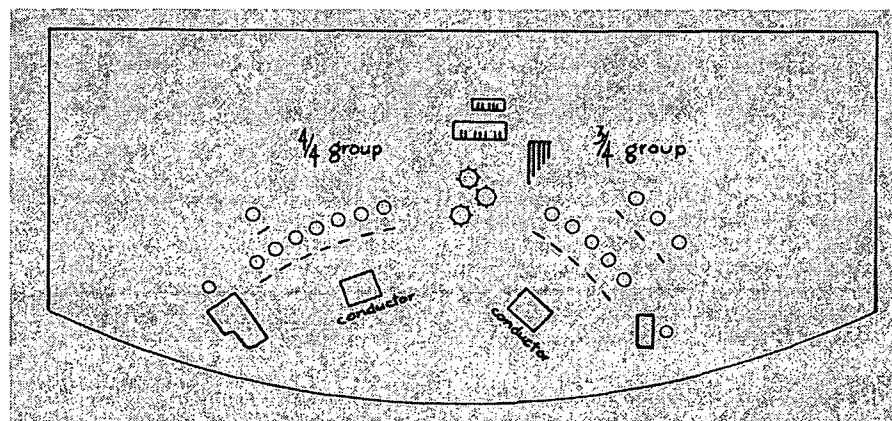
Figure 4-7B. Spatial diagram showing a prohibited distribution of performers. (Image from: Henry Brant, *Verticals Ascending after the Rodia Towers* [New York: MCA Music, 1969].)

Diſtribution of the Orcheſtra at the Opera-Houſe of Dreſden.

Directed by le Sr. Haſſe.

C
C
2

O
R

Explanation of the Cyphers.

1. Harpſichord of the Maſter de Chapelle.
2. Ditto of Accompaniment.
3. Violoncellos.
4. Counterbaſſes.
5. Firſt Violins.
6. Second Violins, with the Back towards the Theatre.

7. Hautboys, the ſame.
8. Flutes, the ſame.
a. Tenors, the ſame.
b. Baſſoons.
c. Hunting Horns.
d. A Tribune on each Side for the Timballs and Trumpets.
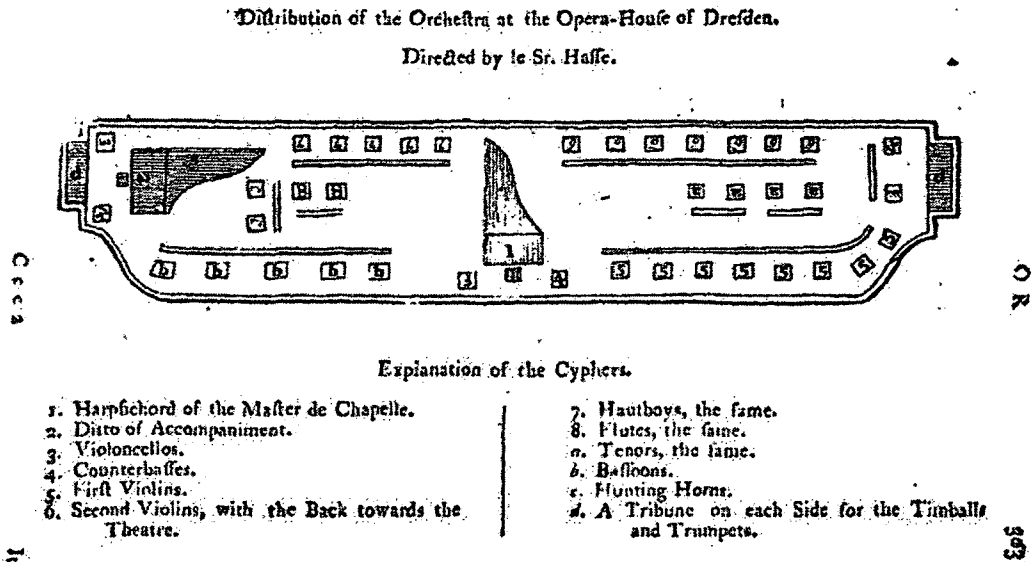
Figure 4-8. Jean-Jacques Rousseau's drawing of the orchestra at the Dresden Opera. (Image from: Jean-Jacques Rousseau, "Orchestra," *A Dictionary of Music,* translated from the French by William Waring [London, 1775], 302.)
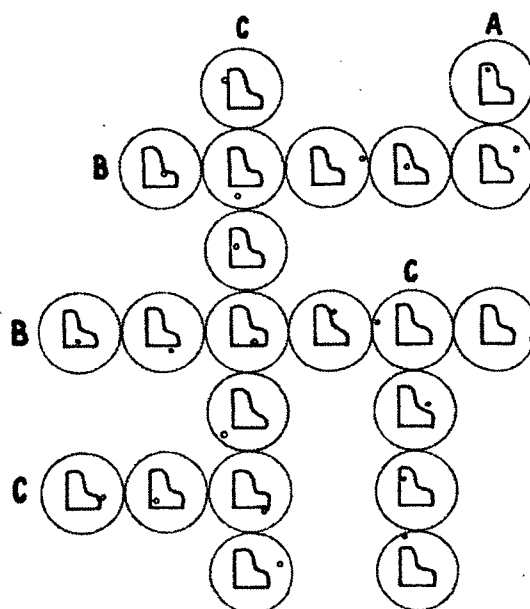
Figure 4-9. Score for *Memories of You* by Cornelius Cardew. (Image from: Cornelius Cardew, *Memories of You* [London: Universal Edition, 1967].)
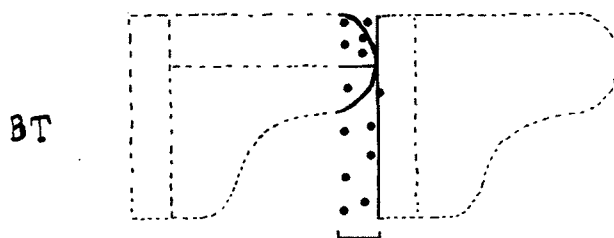
Figure 4-10. Notational fragment "BT" from John Cage's *Concerto for Piano and Orchestra*. (Image from: John Cage, *Concert for Piano and Orchestra* [New York: Henmar Press, 1960].)
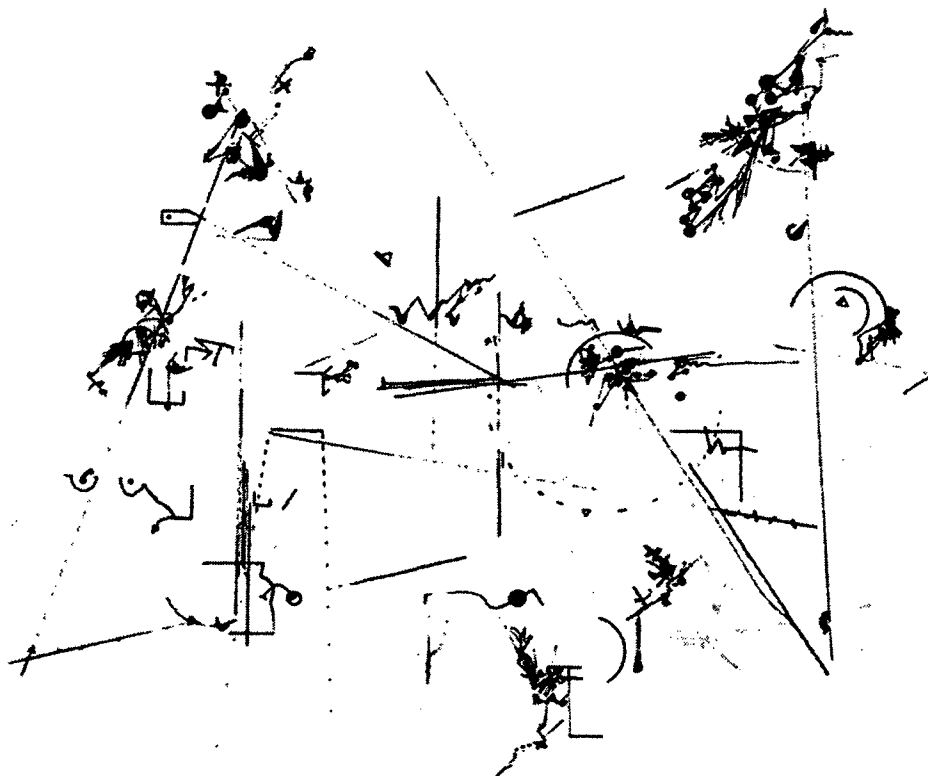
Figure 4-11. Projection for *Titus number 1 for amplified automobile*. (Image from: Brian Moran, "Titus number 1 for amplified automobile," in *Source: Music of the Avant Garde* 2, no. 1 [1968].)
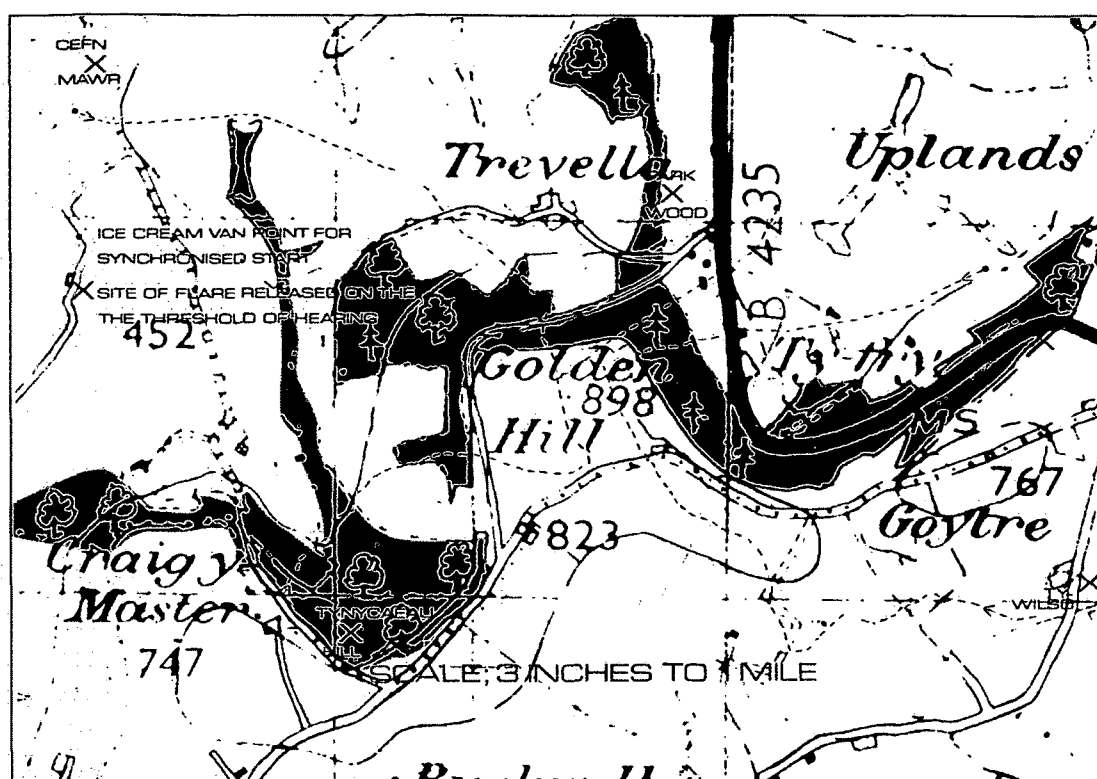
Figure 4-12. Map for "Golden Hill," from *Zones* by Stuart Marshall. (Image from: Stuart Marshall, "Zones (1969-1970)," *Source: Music of the Avant Garde* 10 [1972], 18.)
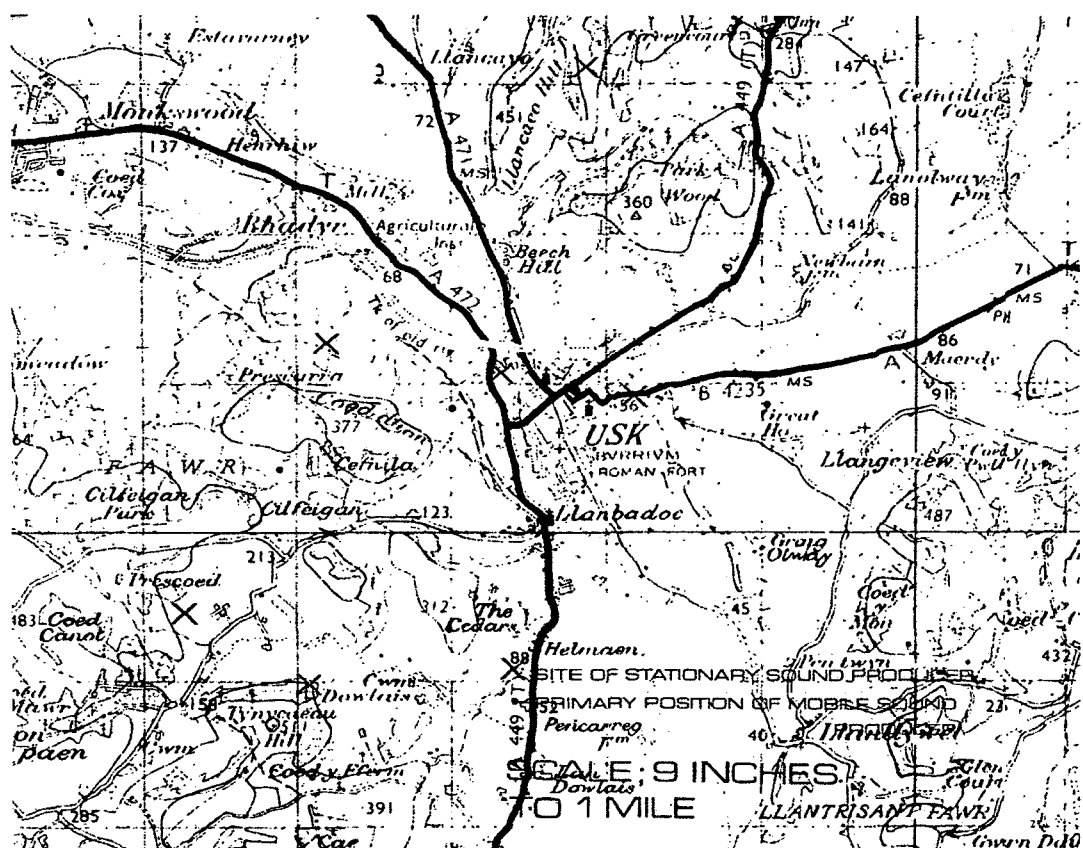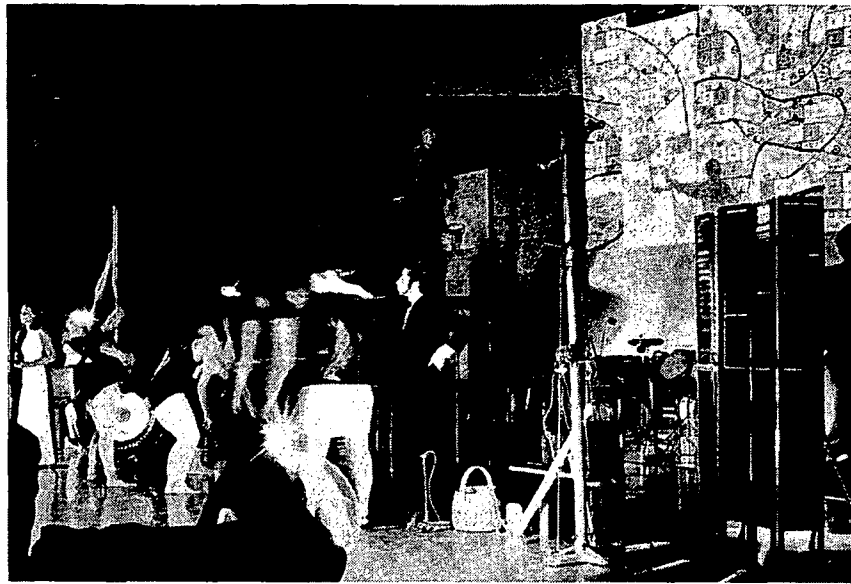
Figure 4-13. Map for "Usk," from *Zones* by Stuart Marshall. (Image from: Stuart Marshall, "Zones (1969-1970)," *Source: Music of the Avant Garde* 10 [1972], 21.)

Figure 4-14. Image for "Synchronized Door Slam," from *Zones* by Stuart Marshall. (Image from: Stuart Marshall, "Zones (1969-1970)," *Source: Music of the Avant Garde* 10 [1972], 14.)

Figure 4-15. Hyper-map score for "Probabalistic Theater I" by Jocy de Oliveira. (Image from: Jocy de Oliveira, "Probabilistic Theater I," image produced from a single 35mm slide, in *Source: Music of the Avant Garde* 2, no. 2 [1968].)

Figure 4-16. Image taken during a performance of *Probabilistic Theater I*, showing the hyper-map score projected behind the traffic conductor. (Image from: Jocy de Oliveira, "Probabilistic Theater I," in *Source: Music of the Avant Garde* 2, no. 2 [1968].)
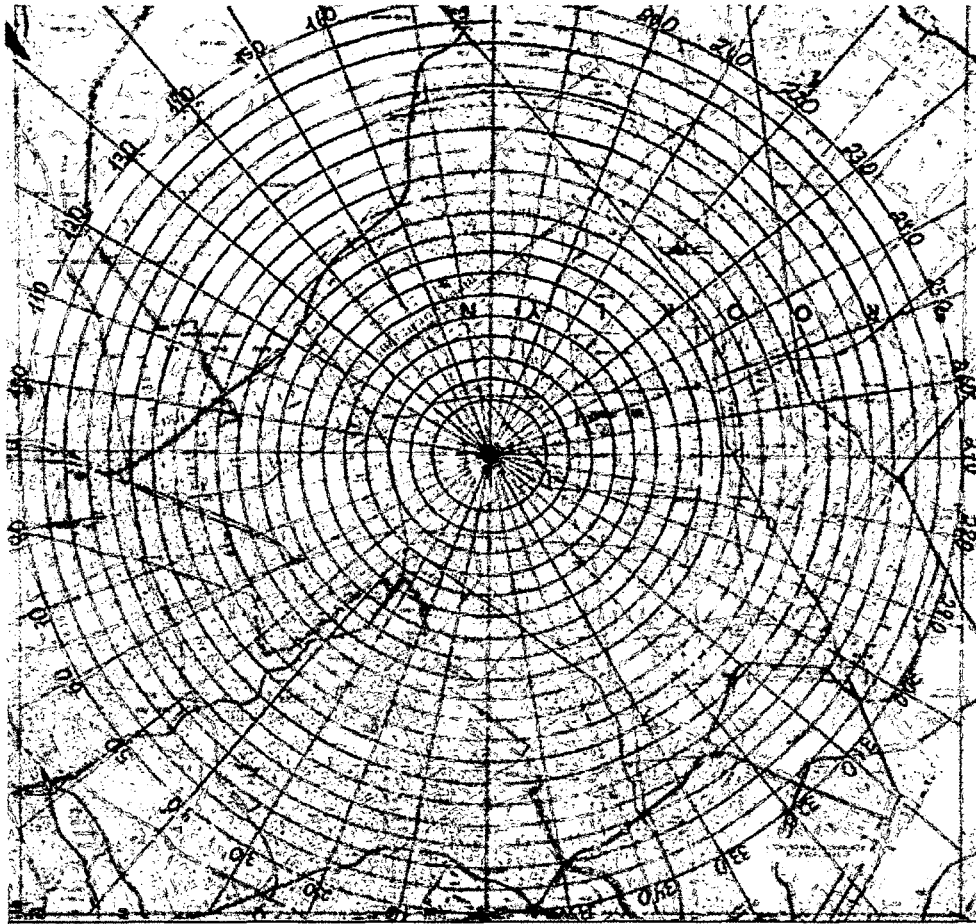
Figure 4-17. Score for *Treasure Hunt (urban event)*. A standard geographic map is segmented into territories that are to be systematically explored, experienced, and "collected" during performance. (Image from: Jocy de Oliveira, *Days and Routes Through Maps and Scores* [Ramona, CA: Lingua, 1983]. 94.)
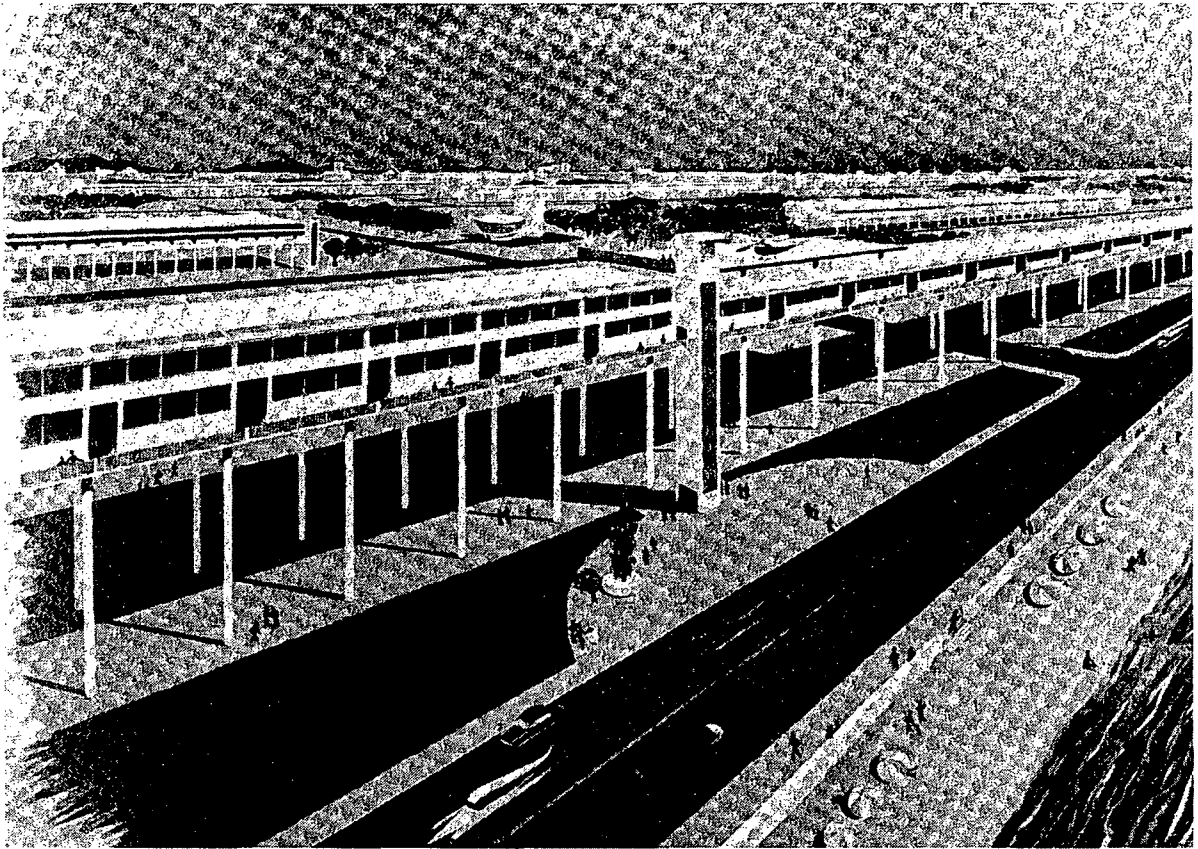
Figure 5-1. Drawing from *La Ville Cybernétique* showing a zone for sleeping. Buildings are oriented horizontally so as to promote sleep; however, Schöffer's plans do not seem to anticipate the effects of a rooftop helipad. (Image from: Nicolas Schöffer, *La Ville Cybernétique* [Paris: Tchou, 1969], insert near page 120.)
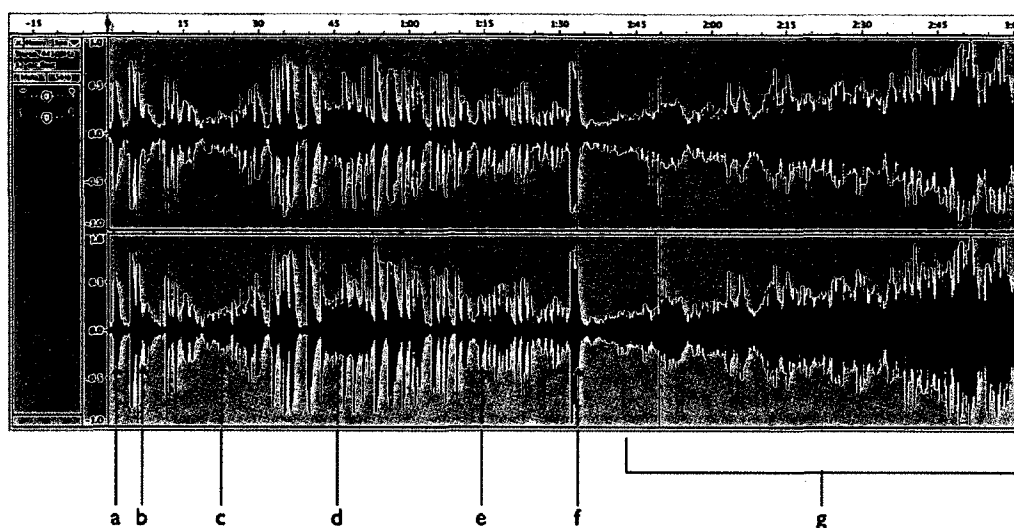
Key

a. punctuated sounds

b. punctuated sounds followed by scraping

c. rattling / rolling

d. period of counterpoint: sustained low tones layered by rattling / punctuated sounds

e. punctuated sounds followed by rattling / rolling

f. bang followed by deep thud

g. building intensity; layered counterpoint: high-pitched sound of bending metal (saw-like); low-pitched rumble; growing frequency of punctuated sounds, bangs, and thuds; ends with loud rattling.

Figure 5-2A. Annotated waveform of *Spatiodynamisme,* composed by Pierre Henry for broadcast from Schöffer's tower in St. Cloud. Image by the author.
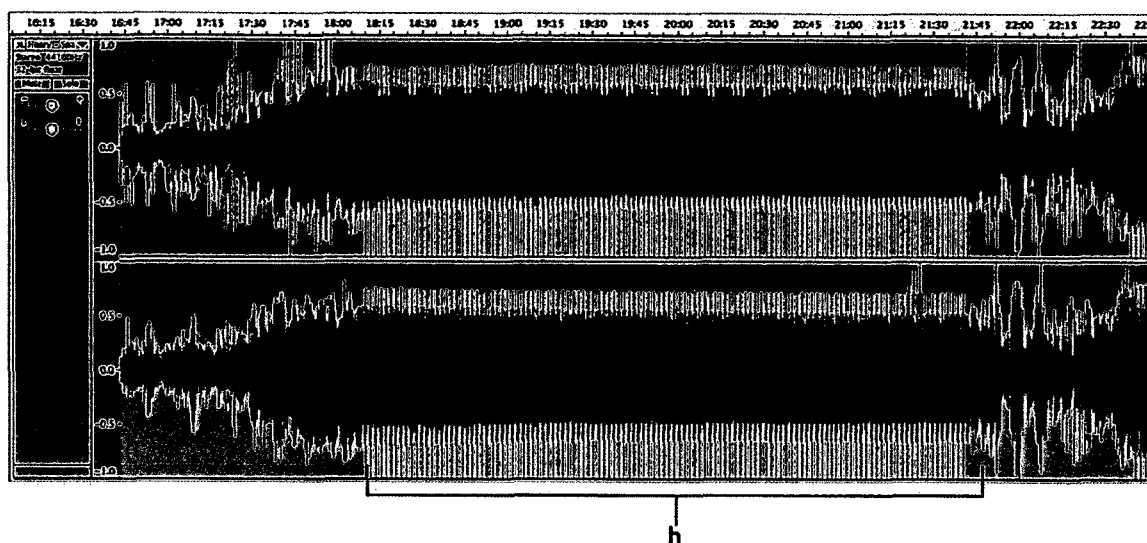
Key

h. sustained looping (about 3 loops per second); rattling, slight pitch bending

Figure 5-2B. Annotated waveform of *Spatiodynamisme,* composed by Pierre Henry for broadcast from Schöffer's tower in St. Cloud. Image by the author.
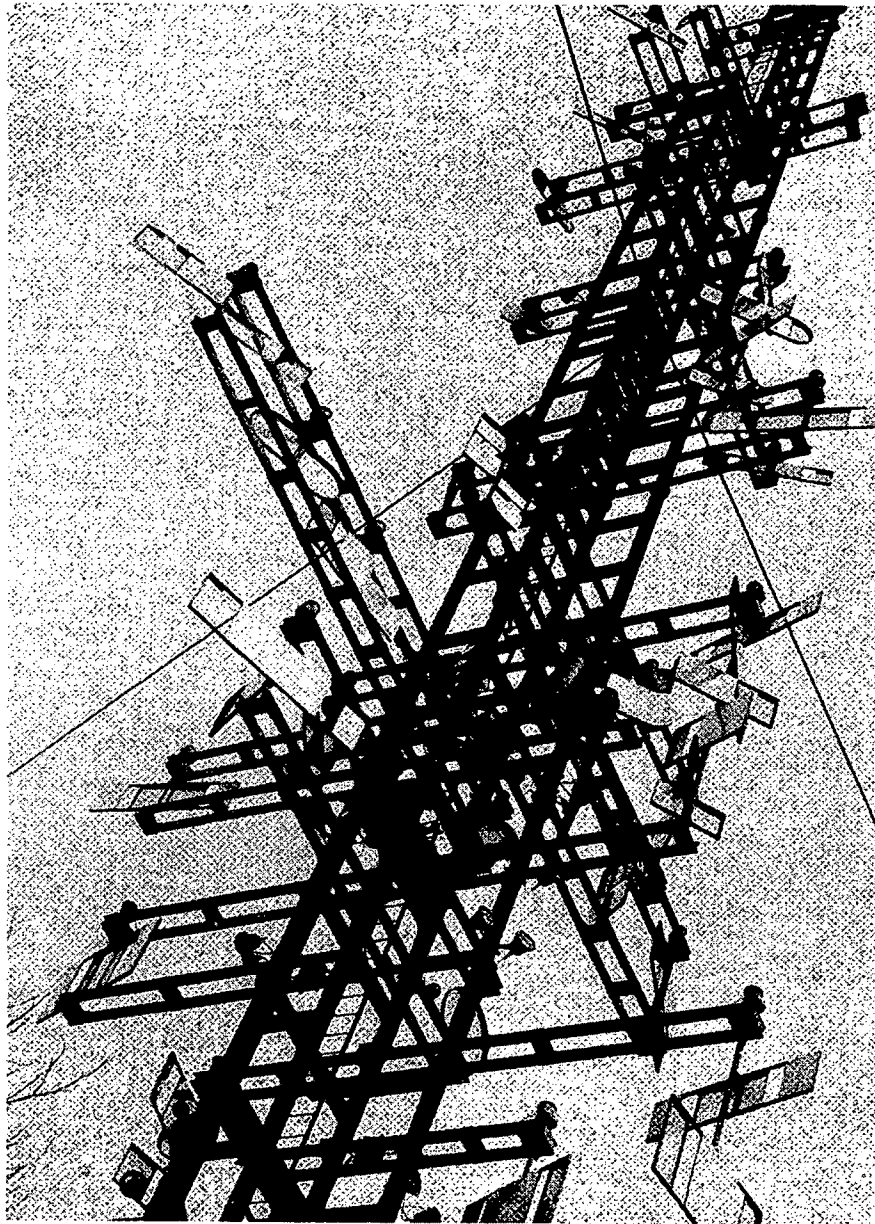
Figure 5-3. Photograph of *Chronos 3*, a cybernetic tower constructed in Liège, Belgium in 1961. (Image from: Nicolas Schöffer, *La Ville Cybernétique* [Paris: Tchou, 1969], insert near page 65.)
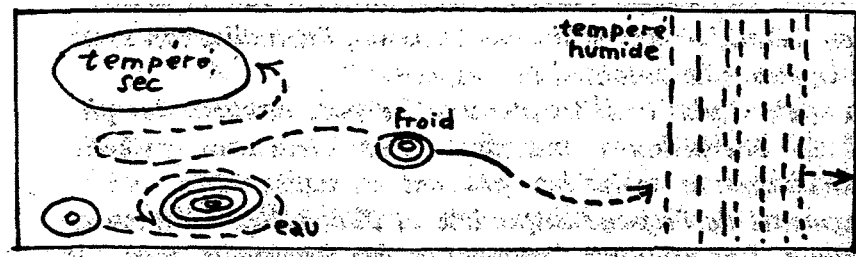
Figure 5-4A. Notational fragment for the topology of weather. (Image from: Nicolas Schöffer, *La Ville Cybernétique* [Paris: Tchou, 1969], 117.)
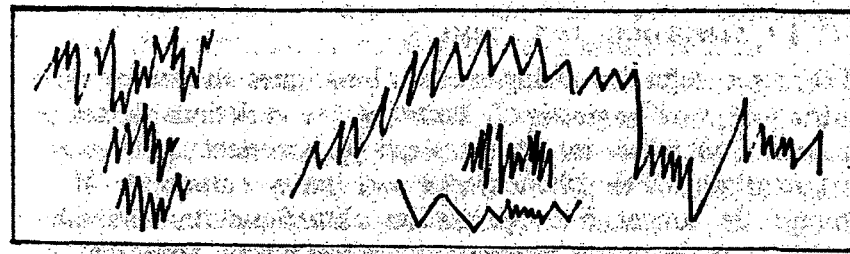

Figure 5-4B. Notational fragment for the topology of sound. (Image from: Nicolas Schöffer, *La Ville Cybernétique* [Paris: Tchou, 1969], 115.)

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