

Noise, Mapping, and the Architecture of Statistics

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Recent discussions within architecture have focused on the idea of spatialized statistics and their relation to building, design, decision-making, and capitalism. These discussions— seen most strongly in Dutch architecture of the last five years, in the work and criticism of such firms as OMA and MVRDV— make two founding assumptions: one, the world is fundamentally a continuum of data, what MVRDV calls a “datascape.” Any building site, any point in space, is not empty”— it is instead almost overdetermined by social, economic, and political statistics. Two, design is fundamentally a manipulation or manifestation of these statistics. In a datascape, the limit-state of the world is a realtime feedback system of data, and the limit-state of design is a harnessing of realtime information and material flows. Architecture becomes a manifestation of extra-architectural “forces,” above all capital (figure 1).¹

Supporting these ideas are two further assumptions about data and technology. First, data is seen as primary, as a conceptually firm ground — as if the data had existed before their ability to be measured, and data-gathering is simply the measuring of quantities which already exist.² Second, the transition of society, and architecture, to a data-saturated and data-driven totality is seen to go hand in hand with the rise of inexpensive computer technology since the 1980s.³ Not only is the realtime data-feedback system posited as the apotheosis of a data-saturated society, but this society is seen as an inevitable outgrowth of advances in technology.⁴

Yet this statistical version of space is ultimately both ahistorical and apolitical, despite the fact that it is located both historically (in the last twenty, or fifty, or eighty years) and politically (as a phenomenon of late capitalism). It is ahistorical because it posits statistics as preexisting their measurement,

the making visible of what simply could not be seen before. And it is apolitical because there is little discussion of who collects the data (and how) or how different kinds of data serve different political or economic ends. The data can be “interpreted” and “manipulated” (either by the state or by designers), but before manipulation, they are seen as neutral, somehow pre-political.

And yet there has been a fierce debate over the implications of the datascape for leftist social change. Critics such as Sanford Kwinter argue that the logic of datascares only reinforces and redistributes the logic of capitalism; he argues that the datascape exhibits the “unsentimental bureaucratic logic” of “neocapitalism”—“the rote numeric sequencing of market behaviors and demographic pressures.”⁵ Conversely, Bart Lootsma argues that the reappropriation of statistical logic by designers instead of bureaucrats represents the radically democratic potential of the architecture of statistics, and idea “deeply rooted in a Western European tradition in which society is considered at once democratic and ‘makeable.’”⁶ But both of these critiques miss a more fundamental point about data: that it is constructed politically even before it is manipulated or interpreted.

This paper is an attempt to approach the assumptions and limitations of the datascape model through the historical analysis of a specific type of map, the noise map. Noise maps, while not directly a part of the rhetoric of recent architectural work, seem to fit very nicely within that worldview: they show the world as a continuum of data not apparent to a more classical, scenographic understanding of space; they rely heavily on computers (all recent noise maps use sophisticated modeling programs and huge data sets); and they map a continuously changing field of a human-created artifact. Many examples of noise maps are readily

available on the internet, and they all seem to have been created since the mid 1990s (see figures 2-5 for the two main kinds of noise maps – contour maps around airports, and ROYGBIV-style maps for congestion in urban centers).⁷ Indeed, noise maps are available for almost all airports in the United States, and more than eleven major European cities. Perhaps not surprisingly, the most comprehensive noise maps have come from Holland (see figure 6).⁸

Looking at these maps more closely, situating them historically and analyzing them politically, it becomes clear that they do not fit the characterization of recent architectural thought. For one, they were initially developed in the 1960s, without the use of computers, and while they do use huge data sets of flight path information, there is no way they might incorporate realtime data-measurement or feedback systems. More importantly though, both the variables they use and the maps themselves are indissociable from an institutional and political history of noise and its regulation. It is a mistake to posit data as politically neutral: not only their use, but their creation and the different units used to express the idea of “noise” are products of competing socio-political interests. Thus in a project like Penelope Dean’s “Noise Scape,” there will be political presuppositions to be found even in the use of time-averaged dB(A) units (see figure 7).⁹

Indeed, when talking about “representation,” a common failure is to see a given representation (such as a noise map) as a manifestation of something which is already “really there.” But as I will show with noise, various methods of representation are tied to different assumptions, measurement techniques, and politico-professional practices – and the changing idea of noise cannot be linked to anything more than these assumptions, techniques, and practices. One of the main arguments of this paper is that representation, as practice, is as much a political as an epistemological act. Thus with every map (or lack of map), the questions that must be asked are not, How can I take advantage of this data? or What would a statistically sophisticated design look like?, but rather Who made this map? Why did they make it? What kinds of response does it allow or disallow? How does it consolidate or fail to consolidate an authority to create change? What kinds of change? Whose interests do these changes further?

In the first decades of the twentieth century, the prevailing understanding of noise was linked to the categorization and taxonomy of individual noise sources. Quantitative measurement – with noise meters and audiometers – was applied equally to all sounds, and regulation was directed towards these individual noise events.¹⁰ Two well-known noise surveys took place in New York City in the late 1920s and early 1930s, organized by city activists who were becoming less tolerant of the clamor of machine-made noises like riveting and traffic. The first survey, in 1926, was a general survey whose modest goals included providing a percentage breakdown of city-corner noise by source, pointing out the particular annoyance of harbor horns, and speculating on why the annoyance of riveters’ noise seemed out of proportion to its noise meter reading.¹¹ The second, larger New York noise survey – the *City Noise* report of 1930 – went much further, measuring not only traffic, subways, and riveters, but subway turnstiles, radios and loudspeakers playing into the street, thirty-two different kinds of car horns, even tiger roars.¹² Both of these surveys involved anti-noise operatives canvassing the city with audiometers and noise meters, taking thousands of individual measurements (figure 8).¹³ Results were presented in the form of pages upon pages of noise spectra charts and decibel tables linking different types of noise events or to specific places in the city (figure 9).¹⁴ A car toot was quantified as more offensive than a paperboy, but the tooting and the truck-rattling was never averaged out or conceived as something larger than a collection of individual events caused by individual citizens. This kind of thinking is nicely expressed in figure 10 – the problem of excessive tooting is linked directly to the driver’s poised right arm.¹⁵

These kinds of tabular, event-oriented measurements were closely linked with a specific strategy of noise control – local anti-noise ordinances. The first of these ordinances appeared in the US in 1929 in Riverside, California, and by 1942, the bulk of major cities had some sort of anti-noise legislation.¹⁶ These ordinances are all very similar, and the specifics echo the measurement techniques of the 1930s noise surveys: they emphasize interdictions on individual noise events like car honking, radio playing, and shouts of street vendors.¹⁷ By the late 1940s, police in New York were issuing citations for broken machinery, barking dogs, even

loud parrots.¹⁸ Anti-noise activists were focused on enacting these laws and battling noise one car toot at a time, and the message of groups like the National Noise Abatement Council emphasized the individual citizen's personal relationship to noise—its 1941 Noise Abatement Week poster (figure 11) shows both sides of this approach: tooting car horns, chiming bells, loud shoes, and steam whistles were all confronted by a police officer on the beat (wielding, oddly enough, a whistle).¹⁹ More than ten years later, the preferred metric of the president of the New York League for Less Noise was still “car toots per minute” (of which there were forty).²⁰ The goal of these efforts and ordinances was not to lower the number of car toots to some acceptable level, but to eliminate them as much as absolutely possible.

It is instructive to look at how early anti-noise efforts approached the idea of the map. It would be foolish to assume that it hadn't been considered, that plotting noise on a map was a postwar novelty. And indeed, the idea of some kind of comprehensive noise map had been present since the very first New York noise survey, but such a map was never drawn – not for technical reasons (the requisite metrological technologies were being developed around the same time), but for what seem to be epistemological constraints. Such a noise map was not the goal of these surveys: the goal was local noise ordinances.²¹ The only map in the 1930 *City Noise* report shows the locations of resident questionnaires that identified traffic noise as a major nuisance (see figure 12) – point sources from direct, individualized data.²² The same is true for a 1934 report by the London Anti-Noise League – their map simply showed the location of the noisiest places in the city, even referring to some that weren't on the map at all.²³ Or consider the map published by the *New York Times* in 1935, which simply overlaid cartoon steam whistles on a featureless map and called it a “Noise Map of Manhattan” (see figure 12).²⁴

Even the idea of a noise map was different in this era. In 1949, after fifteen years of development in noise characterization and metrology, a prominent acoustician argued that “the potential home builder and architect should be able to inspect city maps prepared from [noise] surveys that indicate principal noise sources such as highways, railroads, airports, and factories” – a suggestion very much

in line with the taxonomies of the 1920s, and altogether different from the noise maps that would be published fifteen years later. This map would not have showed noise itself, but noise sources.²⁵ Representing noise directly would require a new conceptual, technical, and regulatory infrastructure, one that would have almost nothing in common with the earlier idea of noise and how to control it.

So how did these pointillistic representations of noise come to be replaced by the noise maps currently posted on the internet? Did measurement technology finally advance to the point where enough data points could be taken and smoothed onto a map? Certainly not. What distinguishes noise maps, above all, is an epistemological reliance on *simulation* – noise contour maps use no directly measured noise data at all, and conceal a radically different idea of how noise levels can be determined (and represented). And just as direct measurement was closely tied to anti-noise ordinances, the simulation-based approach to noise developed simultaneously with new modes of regulation and control. Instead of individual noise sources, the object of noise maps is a large aggregate noise field – the time-averaged algebraic combination of conceptually non-unique noise events.

What could be called the first noise maps (in this simulated sense) were based on FAA planning documents published in the early 1960s to address the concerns of community response to airport noise.²⁶ The making of noise maps was systematized into a six-step process – a process that did not require any direct noise measurements whatsoever. Only the first step was based on site-specific factors at all: the map was based on data such as the number of flights and their routes to and from the runway.²⁷ A statistical average of these paths would lead to the selection of an appropriate noise envelope for each runway (such as in figure 14), which would result in “Composite Noise Rating” contours, ratings which were explicitly dissociated from any sense of measured reality. (The report states explicitly that “the composite noise rating is a calculated quantity; it cannot be measured with a sound level meter or any other indicating device.”²⁸) The Composite Noise Rating was backed up not by direct measurement, but by a wide variety of previous research, such as airplane noise specifications, community response to air force bases, and psy-

chological perceptions of aircraft noise.

This method was then used, with some modifications, in a number of airport noise surveys for both civilian and military airports through the late 1960s and early 1970s.²⁹ The salient feature of these maps was not data-collection, data-processing, or computerized number-crunching, but simulation. And they were developed as an engineering practice many years before the spread of cheap information technology; the first maps produced did not use any computers at all. The 1964 report included worksheet tables to be used for flight path calculations, and explained how trace paper could be used to draw accurate contours. It was almost ten years before a computer program to compute aircraft noise contours was created, and it was initially intended not to make the existing process more sophisticated, but simply to automate it.³⁰

Simulation is thus a precondition of the noise map; however, the link between mapping and simulation is not arbitrary: the use of simulated noise maps goes hand in hand with the desire to represent total noise exposure (not just instantaneous noise level) as a single statistic, varying continuously through space.³¹ The units used on noise maps provide an implicit answer to the question "what is noise?"— and the use of maps instead of data-tables requires the use of different categories of units: the kinds of units used by the noise surveys of the 1930s— such as the now-standard A-scale decibels — cannot be plotted on a map, as they measure instantaneous sound level only. Only time-averaged variables can be used on maps: the so-called—"Day-Night Level" (or DNL) units on noise maps work best for simulated noise levels, as the value on the map must take into account perceptual differences between different qualities of noise and different times of day.³² The decision to map, the use of simulated noise predictions, and the use of abstract, time-averaged units are all part of the same system — each implies the others.

The use of time-averaged units has important consequences for trying to understand actual noise events, or even what is actually being represented. For example, because DNL units are averaged over an entire year, a very loud noise experienced rarely does not have much impact. Thus one method that airports use to keep their DNL contours within acceptable limits is—"fanning"— directing planes away from the airport on a wide range of trajectories

instead of using the same flight path every time. So instead of one line on the map having the majority of noise events, a much wider area will be subject to fewer events each. This is used most aggressively with the loudest planes. Figure 15 shows the process of fanning in a year's flight paths for propeller planes (which are much louder than modern jets) leaving Boston Logan airport.³³ There is the same amount of total noise, and the same (or similar) number of person-annoyance events, but the DNL level is everywhere reduced.

It is also important to remember why weighted, time-averaged noise levels were first invented in the early 1960s. The Composite Noise Rating was correlated with the type and amount of community response, where a high rating could go so far as to predict "vigorous community action" (see figure 16).³⁴ Indeed, this index was originally developed to help plan expansions to Air Force bases, where vigorous community action could hinder national security. But even in 1970, expert discussions began to point to the complications this strategy might pose for democracy: regardless of the predictive power of noise maps, the citizenry might in fact be interested in direct representation, instead of maps of simulated response. Yet although one scientist saw airport noise as a social problem on the order of "the Black ghetto, the Vietnam War, the student revolt, and community schools," he also suggested that all that mattered might be a community's feeling of involvement, as their actual interests, "from a technical standpoint," would already be well represented.³⁵

Note how the issues at stake here are different than the ones discussed by Kwinter and Lootsma: it is irrelevant whether the use of statistical decision-making represents the apotheosis of capitalism or the resurgence of democracy (it can be either) when the statistics themselves codify anti-democratic decision-making. It is not a simply question of whether to engage statistics, but of who creates them, and how, and for what ends. And it is not just that the development of noise maps went hand-in-hand with the desire to cut the citizenry out of decision-making, but that this desire was designed into the statistical units themselves. It is impossible to use DNL units

without engaging this history, as they do not ultimately measure noise at all — they measure the

predicted community response to a yearly average of aircraft flight patterns.

The FAA was not the only agency interested in noise in the 1970s. The EPA, HUD, and DOT also sponsored noise research or regulation, but they used noise maps rarely, if ever. Instead, these agencies continued to use the techniques and vocabulary of the noise surveys of the 1930s— even after noise maps had been developed and their methods widely disseminated, noise surveys based on direct measurement continued to be done. Some of these reports were internal investigations by places like New York City or Denver trying to understand their own noise problems. Other reports attempted to measure the noise characteristics of a “typical” mid-sized US city like Medford, Massachusetts or provide “typical” data on various residential conditions.³⁶ And again, just as with the *City Noise* report of 1930, the tables and maps published by these other agencies show measurement locations and point data, not time-averaged contours (those from the 1970s³⁷ just as much as one from 1995³⁸ – see figures 17 and 18). The focus of the reports made outside the FAA is on tables of data, not maps, and their recommendations are concerned with individual sources like truck tires or garbage bins. And these reports still included photos of their trucks and their ever-serious noise operatives; only the styles had changed (see figures 19-21; compare to figure 8.)

Why were these surveys still being done, given the availability of simulation expertise or computer programs? And why did the FAA make extensive use of mapping? The difference lies in the scale of institutional interest: agencies like the EPA and the HUD were designed to provide services to individuals, either through the regulation of hedge-trimmer noisiness, or the protection of the mortgage value of public housing.³⁹ The situation with the FAA is the opposite: its focus was on issues at the scale of the national economy, and its primary responsibility was fostering the aviation industry, the “development of civil aeronautics and air commerce in the United States.”⁴⁰

So just as the pointillist representations of measured noise events from the 1930s went hand in hand with local anti-noise ordinances directed towards individual noise events, the difference between the noise-representation regimes of the EPA or local municipalities and those of the FAA was

related to the types of regulation those agencies were attempting to enact. The EPA was still concerned with characterizing specific noise environments and controlling individual noise events. But from the beginning, the FAA had a broader goal – in the mid-1960s, its head administrator realized that airport noise could slow future expansion of the aviation industry, and he took steps to protect that industry from its own noise problem.⁴¹ But the FAA treated the problem at the level of the transportation system as a whole, with such regulations as the Fleet Noise Level, which was the average noise performance of an airline’s entire fleet, and the extensive use of standardized noise maps for planning airports.⁴² The logic was explained by an industry spokesperson: requiring strict noise regulation “on the basis of only the most noise-sensitive airports would impose inequitable and unjustified penalties on the total air transportation system.”⁴³ In order to combat noise without hamstringing industry, the FAA pursued with national industry-wide regulation that takes years, if not decades, to effect change in actual noise levels, and noise maps were (and still are) an important part of this process.

The development of noise maps thus should not be seen as a more representationally sophisticated practice than tabulated noise data, and certainly not one due to the explosion of inexpensive computers. Noise maps are not an evolution from within direct noise measurement, but a parallel representational regime in line with a specific regulatory mandate. The characteristics of the airport noise contour maps – weighted, time-averaged units representing simulated noise levels from airplanes only – reinforce the FAA’s broader goals of protecting the national system of airports and the economic interests of the airlines. The important feature of this system is not simply an explosion of data, à la MVRDV’s datascape, but rather an expansion and consolidation of the ties between governmental data and governmental mandates.

Maps, and noise maps especially, are the purview of government agencies; they both represent and consolidate state authority – this has been the case since the invention of the modern state.⁴⁴ And so recent noise maps like the one of Paris (figure 1) are only incidentally a new way of seeing the city. More importantly, they are analogous to the system of airport noise maps required by the FAA, as the mapping of major European cities is part of a

systemic, Europe-wide approach to noise regulation, at the level of the truck fleet of all of Europe, land planning around airports, and fleet-level changes in aircraft noise emissions.⁴⁵ The use of noise maps by the EU signals a broadening of the legislative scale and scope of the European Union. The more large-scale statistical maps are used, the more regulatory authority is consolidated at a higher political level.⁴⁶

An important question is thus, What is new here? Why are architect-theorists interested in "the new cartography" in the late 1990s, and how can noise maps be described as a totally new way to see Europe?⁴⁷ Both Lootsma and Aaron Betsky discuss Modern architecture's previous engagement with statistics: planners involved with CIAM had attempted to quantify Amsterdam urbanism in the late 1920s,⁴⁸ and data-based decision-making was again part of the later CIAM meetings of the 1950s.⁴⁹ Statistical cartography was in use even earlier: in the last decades of the nineteenth century, the French government began publishing sophisticated demographic maps of Paris that showed everything from mortality rates to capital flows.⁵⁰

So perhaps in the case of Dutch datascares, statisticians' recent resurgence is indeed linked to the rise of inexpensive information technology, but not for the cited reasons: cheap computers, the internet, and easy access to Geographical Information Systems (GIS) are indeed novel and are already having a profound impact on the idea of "public information." But the noise maps posted on the internet should not be seen as the opportunity for the public to appropriate government-controlled data, but rather as part of new attitude towards public engagement and the diffusion of maps as a way of symbolizing governmental expertise. Indeed, one of the defining features of GIS is that it only allows access to data which has been previously compiled by larger agencies. And the difference between data-diffusion and data-creation is profound: while increasing access to data does allow for new forms of critique and accountability (the democratic potential of MVRDV that Lootsma discusses), no amount of data flow allows for access to the hidden assumptions of the "raw" data itself. By the time the "new cartography" has become available for architects, the basic givens of governmental planning have already been designed into it.

NOTES

¹ For a sampling of these ideas, see the following five books: Rem Koolhaas et al., *Mutations* (Bordeaux: Arc en Rêve Centre d'Architecture; Barcelona: ACTAR, 2001), especially Sze Tsung Leong, "Control Space" (pp 184-195), the Harvard Project on the City, "The New Cartography" (pp 178-183), Aldo Bonomi, "Smooth Space" (pp 450-459), Bart Lootsma, "The New Landscape" (pp 460-471), Stefano Boeri, "Notes for a Research Program" (pp 356-377), and Friedrich Kittler, "What's New About the New Media" (pp.58-69). Rem Koolhaas et al., *Harvard Design School Guide to Shopping* (Köln: Taschen; Cambridge, MA: Harvard Design School, 2001), especially Sze Tsung Leong, "Ulterior Spaces" (pp764-795). Gausa, Guallart, Müller, Soriano, Porras, & Morales, *The Metapolis Dictionary of Advanced Architecture: City, Technology, and Society in the Information Age* (Barcelona: ACTAR, 2003), specifically "Cartographies," "Maps (To Map)," "Data," "Data-Driven Forms," "Datascapes," and "Diagrams." MVRDV, *Metacity/Datatown* (Rotterdam: 010 Publishers, 1999) and MVRDV, *Farmax: Excursions on Density* (Rotterdam: 010 Publishers, 1998).

² For example, see "Data-Driven Forms" in the *Metapolis Dictionary*, op. cit. There are some exceptions, such as Lootsma, cited below, who acknowledges that data are but "the language of our times." His characterization of data as a language, however, is open to critique.

³ For example, see Aaron Betsky, "MVRDV: The Matrix Project" in Véronique Patteeuw, ed., *Reading MVRDV* (Rotterdam: NAI Publishers, 2003), where he makes the equation Information Age = computers = very recent phenomenon" MVRDV, pp 11-13.

⁴ For example, see Sze Tsung Leong's articles on realtime information feedback systems in *Mutations* and *The Harvard Design School Guide to Shopping*, op. cit., where the prime mover is implicitly technology; social or ontological mutations are derivative: "In subsuming space to the statistical, it [the "control space" of data-feedback] announces the obsolescence of three-dimensional space" (187). see also the definitions in the *Metapolis Dictionary*, op. cit.

⁵ Sanford Kwinter, "La Trahison des Clercs (and other Travesties of the Modern)" in *ANY: Architecture New York* 24 (2000), pp 62-61.

⁶ Bart Lootsma. "What Is (Really) To Be Done?" in Véronique Patteeuw, ed. *Reading MVRDV* (Rotterdam: NAI Publishers, 2003), page 25.

⁷ The four maps shown are from: "2000 Noise Contour: Chicago O'Hare International Airport." (online at http://www.ohare.com/cnrc/ohare/_noise_2000contour_pres1.shtm, released August 3, 2001, accessed December 2003) contour map is on slide #12. "Paris publie sa cartographie du bruit routier

moyen" (online at http://www.paris.fr/fr/environnement/bruit/carto_bruit/, posted May 2003, accessed December 2003.) Vanasse Hangen Brustlin, Inc., *2002 Environmental Data Report for Boston Logan International Airport* (Boston: Massachusetts Port Authority, September 2003) contour map on page 17 of chapter 6, and J. Hinton, *A Report on the Production of Noise Maps of the City of Birmingham* (London: Department of the Environment, Transport, and the Regions, 2000).

⁸ "Noise and Traffic" (online at <http://www.xs4all.nl/~rigolett/ENGELS/>, updated 1998-2003, accessed December 2003). Some maps similar to the one shown are labeled as being created in 1996.

⁹ Originally published in MVRDV, *Farmax*, op. cit. This figure taken from *The Metapolis Dictionary*, op. cit., page 150.

¹⁰ For a discussion of early sound metrology, see Emily Thompson, *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933* (Cambridge, MA: MIT Press, 2002), as well as Karin Bijsterveld, "The City of Din': Decibels, Noise, and Neighbors in the Netherlands, 1910-1980" in *Science and the City*, Osiris 18 (Philadelphia: History of Science Society, 2003), page 184.

¹¹ E.E. Free, "Noise: The Forum's Second Report on City Noise," 1928. unlabeled pamphlet. Reprinted in *City Noise* (see next citation).

¹² "Although a roaring lion would be audible in our streets at a distance of twenty or thirty feet, there are many places where a tiger from Siberia or Bengal could roar or snarl indefinitely without attracting the auditory attention of passersby." "Noise Abatement Commission of New York, *City Noise* (New York: Academy Press, 1930). pp 42-65 (quote on page 42).

¹³ *Ibid.*, page 32.

¹⁴ see also the discussion of metrology in the early urban noise surveys in Thompson, op. cit., pp 148-151.

¹⁵ *City Noise*, op. cit., page 49.

¹⁶ National Noise Abatement Council, *Anti-Noise Ordinances and Other Measures For The Elimination of Unnecessary Noise In 165 U.S. Cities* (New York: The Council, 1942). Of 165 cities polled, 89 had specific anti-noise ordinances, 65 did not, and 11 had some "other" form of noise legislation. The NNAC was formed in 1940 as a consolidation of forty local anti-noise groups throughout the country. It was probably the most active and well-organized anti-noise group to date.

¹⁷ The following sources are typical: the "Standard Noise Ordinance of the New York Noise Abatement Commission" (press release from Shirley Wynne, New York Health Commissioner, 1932) and The Boston Noise Commission, "Report of the Boston Noise Commission" (Boston: City of Boston Printing Dept., 1932) present

model ordinances. The 1949 *City of Buffalo Anti-Noise Ordinance* shows these ideas as legislated.

¹⁸ "Police Out to Hush 'Needless Noises'" in *New York Times*, April 2, 1946, page 29.

¹⁹ "National Noise Abatement Week Poster," in *New York Times*, May 3, 1941, page 17.

²⁰ "City Auto Din Times at 40 Toots a Minute," in *New York Times*, April 13, 1953, page 29.

²¹ E.E. Free, op. cit., page 383, describes the characteristics a postwar noise map almost exactly, but such a map are irrelevant for his ultimate recommendations (page 284).

²² op. cit, p. 30.

²³ "London Noises Mapped" in *New York Times*, March 18, 1934, page SM18.

²⁴ Henry Curran. "Curran Calls New York Too Patient About Noise" in *New York Times*, September 15, 1935, page E10.

²⁵ Leo Beranek, "Design for Acoustics" in *Physics Today*, vol 2, n. 7 (1949), pp 18-22. Quote on page 22.

²⁶ Two main reports are relevant – from 1960 and 1964: US Federal Aviation Agency, Airports Division, *Aircraft Noise Abatement* (Washington DC: Airport Planning Branch, Airports Division, Bureau of Facilities and Material, 1960), and Bolt, Beranek, & Newman, Inc., *Land Use Planning Relating to Aircraft Noise* (Springfield, VA: National Information Service, 1964).

²⁷ *Land Use Planning Relating to Aircraft Noise*, op. cit., page 6.

²⁸ *Ibid*, page 2.

²⁹ For example: Peter Franken, *Aircraft Noise and Airport Neighbors: A Study of Logan International Airport* (Springfield, VA: National Technical Information Service, 1970), prepared by partners of Bolt, Beranek, & Newman, Inc. for USDOT and HUD. Melville Branch, *Out-door Noise and the Metropolitan Environment: Case Study of Los Angeles with Special Reference to Aircraft* (Los Angeles: Department of City Planning, 1970). Clifford Bragdon, *Noise Pollution: the Unquiet Crisis* (Philadelphia, University of Philadelphia Press, 1970). Tracor Inc., *Aircraft Noise Study for Naval Air Station Corpus Christi, Texas, and Naval Auxiliary Landing Fields Waldron and Cabaniss* (Austin, 1974).

³⁰ The program was designed in 1971. See US EPA Office of Noise Abatement and Control., *Summary of Noise Programs in the Federal Government* (Washington DC: U.S. Environmental Protection Agency, 1971), no pagination; source is about halfway through the book, in the section detailing the FY 1971 noise programs at the DOT. The 1974 Tracor, Inc. report, op. cit. page B-4, cites the "standard computer routine" as being released a few years later, on December 27, 1972.

³¹ On the desirability of a single-number metric, see US Environmental Protection Agency Office Of Noise Abatement And Control, *Information On Levels Of Environmental Noise Requisite To Protect Public Health And Welfare With An Adequate Margin Of Safety* (for sale by the Supt of Docs, US Govt Printing Off, March 1974). page A-4.

³² DNL units add a 10 dB(A) penalty for nighttime noise. There were originally a panoply of different noise-map units, such as PNdB, NEF, NNL, sones, noys, and many others. The specific differences between these units are an interesting lesson in social construction and bureaucratic decision-making, which I develop elsewhere.

³³ *2002 Environmental Data Report for Boston Logan International Airport*, op. cit., chapter 6, page 14. Notice as well that not all departure tracks are from recorded data: the dark blue lines represent modeled departure tracks, presumably because not all planes were captured by radar.

³⁴ from

Aircraft Noise Abatement, op. cit., page 6.

³⁵ Raymond Bauer, "Predicting the Future" in *Transportation Noises: A symposium on Acceptability Criteria* (Seattle: University of Washington Press, 1970), pages 250, 252, 255, 249. This kind of logic was not isolated: a 1971 EPA report states that "in the recent past community protests registered by the poor have taken a very direct and violent form. Might not increasing levels of noise contribute to this type of action again in the future?" from US EPA Office of Noise Abatement and Control, *The Social Impact of Noise* (Washington DC: U.S. Environmental Protection Agency, 1971), page 18.

³⁶ This continued through the 1990s – see for example U.S. Department Of Transportation, Federal Highway Administration Office Of Environment And Planning, Noise And Air Quality Branch, *Highway Traffic Noise Analysis*

And Abatement: Policy And Guidance (Washington, DC, 1995), pp 24-26.

³⁷ See, for example,

NY Mayor's Task Force on Noise Control, *Toward a Quieter City* (New York, 1970). or Transportation Systems Center Noise Abatement Group, *A Community Noise Survey of Medford, Massachusetts* (Springfield, VA: National Technical Information Service, US Department of Commerce, 1971).

³⁸ Denver Department of Environmental Health, Environmental Protection Division, *Denver Noise Survey 1995 and Analysis of The Denver Noise Control Ordinance* (Denver: The Department, January 1997).

³⁹ *Noise In Urban and Suburban Areas*, 1967, op. cit. "The Department of Housing and Urban Development and the Federal Housing Administration are concerned with the livability of properties for which mortgage insurance is issued."

⁴⁰ FAA, *Aircraft Noise Abatement*, 1960, op cit., page 2.

⁴¹ Richard Kent, Jr., *Safe, Separated, and Soaring: A History of Federal Civil Aviation Policy, 1961-1972* (Washington DC: US Department of Transportation, Federal Aviation Administration, 1980), pp 158-160.

⁴² *Ibid.*, pp 310-312.

⁴³ John Stephen, quoted in *Ibid.*, page 283.

⁴⁴ For example, see Antoine Picon, *Le dessus des cartes: un atlas parisien* (Paris: Pavillon de l'Arsenal; Picard, 1999) for a discussion of mapping in relation to early modern France.

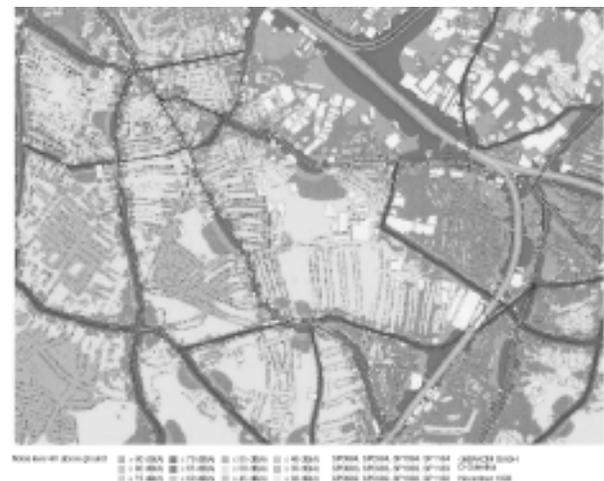
⁴⁵ *Future Noise Policy: European Commission Green Paper* (Brussels, 1996), pp 17-18.

⁴⁶ Cf. the observation by Lootsma (op. cit., page 53) that

Figure 1: "The New Cartography," from Mutations, 2001.



Figure 2: Noise map of Birmingham, England, published 2000.



inasmuch as Hilberseimer and Le Corbusier advocated planning on a new regional or national scale, some of MVRDV's most ambitious datascaping projects reveal an approach to planning on a global scale.

⁴⁷ For the non-architectural techno-newness of noise maps, see John Leicester, "Europe Begins Program to Reduce Noise" (Associated Press wire report, December

8, 2003).

⁴⁸ Lootsma, op. cit., page 37.

⁴⁹ Betsky, op. cit., page 15.

⁵⁰ Antoine Picon, "Nineteenth-Century Urban Cartography and the Scientific Ideal: The Case of Paris" in *Osiris 18: Science and the City* (Philadelphia: History of Science Society, 2003), especially pp 146-149.

Figure 3 Traffic Noise Maps of Paris (10ème arrondissement), showing street-level (above) and façade-incident noise. Published 2003.



Figure 4: Comparison of 60 [outermost] – 75 [innermost] DNL Contours for 2001 [red] and 2002 [blue] Operations" at Boston Logan Airport, published 2002.

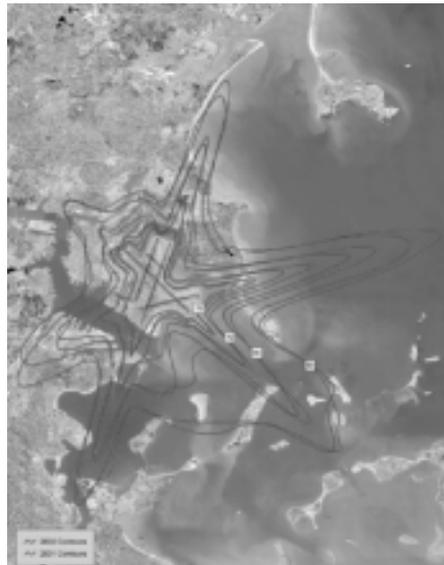


Figure 5: Noise Contours from Chicago O'Hare Airport, 2001.

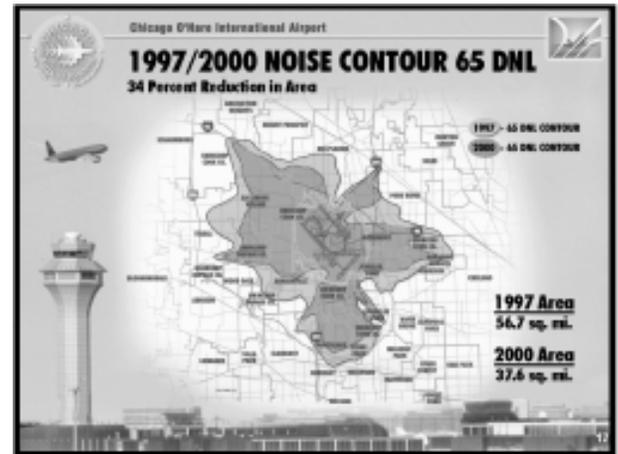


Figure 6: Noise Map of Holland, 1996?



Figure 7: Penelope Dean's Noise Scape, with MVRDV, 1998.

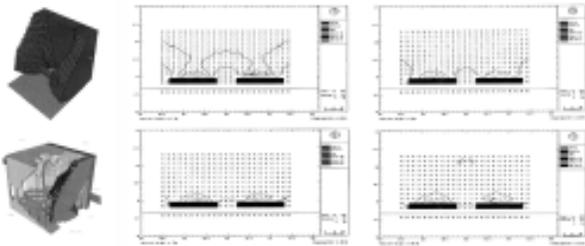


Figure 8: "The noise measuring truck traveled over 500 miles in city streets, observing noise levels at 138 stations."



Figure 9: Data from City Noise, 1930.

Location	Noise Level in Decibels		
	Minimum	Average	Maximum
42nd St. and Vanderbilt Ave.	63	67.5	73
5th Ave. B. 42nd St., & W. Corner at Public Library	60	67.5	74
Queen's Boulevard between 35th & 38th Sts.	53	62.5	68
Park Ave. and 184th St.	56	62.5	68
Broadway at Lincoln Square	53	64	75
Druidy: Manhattan Ave. S. of 10th St.	58	64	78.5
Herald Square, 35th St. between Broadway and 4th Ave.	60	64	80
Broadway and 42nd St.	68	68.5	77
Queen's Boulevard between 34th and 37th Sts.	54	60	70
West and Boheme Sts.	64	69	70
Broadway and 59th St.	64	69	76
30th Ave. between 15th and 16th Sts.	68	69	78
Canal St. at Broadway	58	60	87
West and Canal Sts.	64	69.5	76
East: Avenue A. S. of Park. from Road at F. St. No. 15	58	69.5	84
Broadway between West 8th St. and Catherine Lane	61	70	80
Broadway between Cedar and Liberty Sts.	66	70.5	76
Broadway and 14th St., S. E.	62	70.5	78
ORBIT	62	70.5	80
Broadway and 53rd St.	61	70.5	80
54th St. and 16th Ave.	60	70.5	77
Broadway and 23rd St., S. E.	60	70	84
ORBIT	61	70	78
14th St. and 7th Ave.	61	71.5	78
Broadway between Rector St. & Exchange Place	61	72	86
Broadway at Canal St.	61	72	86
14th Ave. and 5th St.	58	72	81

*Noise objective indicated, the highest value in the Borough of Manhattan. All measurements reported in this table were made between 24 hours of 1930 A.M. and 1930 P.M.

Figure 10: "Tooting the automobile horn instead of ringing the doorbell is a widespread source of noise."



Figure 11: National Noise Abatement Week Poster, 1941.



Figure 12: Map of "traffic noise as revealed in the November questionnaire." from City Noise, 1930.



Figure 13: "Noise Map of Manhattan," "New York Times, 1935: "The ten worst offenders, in the order of their nuisance value, are: (1) automobile horns tooted unnecessarily; (2) trucks that rattle; (3) news boys who bellow; (4) pneumatic drills; (5) street cars; (6) elevated trains; (7) radios; (8) riveting; (9) low-flying airplanes, and (10) boat whistles and fog horns."



Figure 15: Non-jet departures from Boston Logan airport in 2002, showing the practice of "fanning."

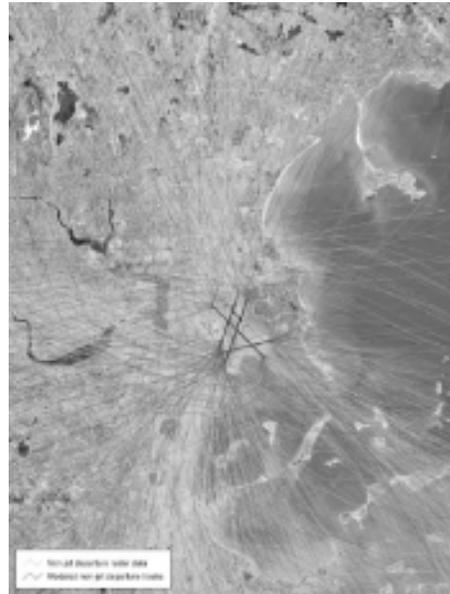


Figure 14: Perceived Noise Level contours for jet aircraft, from Land Use Planning Relating to Aircraft Noise, 1964.

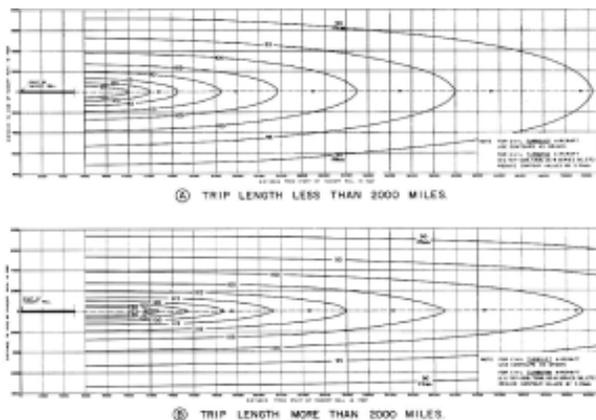


Figure 16: Community Response and CNR, from the 1960 FAA report on noise measurement and contour mapping.

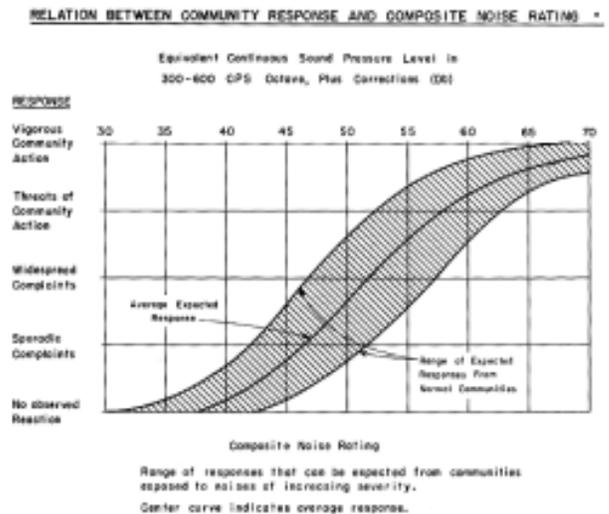


Figure 17: Tabular data from a measured noise survey of Medford, Massachusetts, 1971.

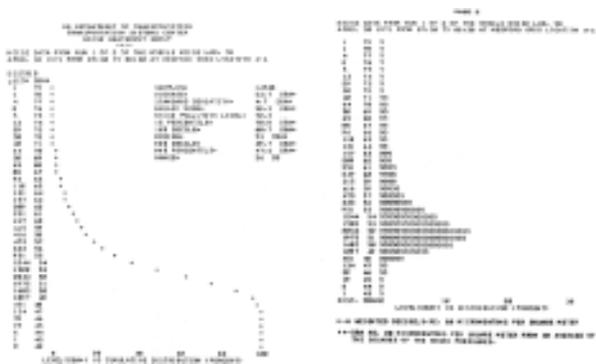


Figure 20: The high-tech, high-style van of the Medford noise survey, 1971.



Figure 18: Measured Day/Night Noise Levels from a 1995 survey of Denver, CO.

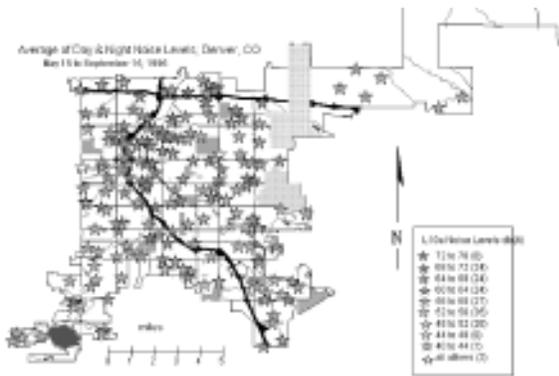


Figure 21: The accompanying high-tech high-style noise operative.



Figure 19: A noise operative investigating the acoustic performance of Montréal's rubber-tired subways, 1970.

