Nikolaus Hirsch, Julieta Aranda, Brian Kuan Wood, and Anton Vidokle

Editorial— "Architecture as Intangible Infrastructure," Issue One

Architecture remains the most tangible way of constructing the social. Yet, the system we call "architecture" is not reducible to the physical, the tactile, the obvious. In the history of avant-garde architecture, immateriality and intangibility carried a promise of liberation, of escape from the heaviness of building, from completion, from gravity or reality. A new contemporary architecture would be built out of pure knowledge—drafted on paper as an idea to be shared, never bogged down by the technicalities of constructing in dimensional space, or even any spatial paradigm altogether. The history of the avant-garde can't—as Beatriz Colomina has pointed out—be separated from its engagement with media and communication. Building would move at the speed of thought and spirit, superseding calculation, regulation, codes, and existing infrastructure.

Architects today do not conceptualize their work in such radical terms. Is it because they are too busy stalking clients in China and the Gulf? Maybe. But at the same time, architects today also have to contend with the fact that other immaterial, intangible forces have subordinated much of the spatial thinking that historically situated architecture in relation to the building and planning of spaces and cities. As Keller Easterling has written in a previous essay, "it is as if architecture, as customarily defined, cannot access some of the most important levers of explicit, measurable spatial change, leaving control of them largely to the financial industries."

But what are these levers? Or for that matter, how has architecture always given form to the immaterial or intangible spatial effects in communication pathways, or war, rubble, memory, tourism, and cultural capital? Hasn't architecture always provided a way of reading ethical transgressions in reverse, of giving them form, for better or for worse? How has physical architecture always been a symptom of ideology? How has it always been a communications infrastructure?

How, then, can we contextualize more recent advances in registering and distributing space, in order to place them back into the history of architecture? Just look at how something like Airbnb abstracts and dissolves, even fiscalizes, core notions such as what constitutes a home. And it presents this as data before an economy of sharing and selling that takes place above and beyond architectural intervention. In the cities where Airbnb is being used most heavily, it is planning urban space, but without urban planners. Except maybe someone like Molly Turner, Airbnb's new director of public policy, who is an urban planner, and describes Airbnb as part of a "third wave of tech ... taking all of the connectivity and transactions that are occurring online and bringing them back offline into the real world."

Airbnb can be part of a new integrated meta-architecture that involves the pooling and marketing of space in a way

where, in a broad sense, architectural interventions on the level of building tend to serve as decorative afterthoughts to the capture and recording of not only space, but also of practices, representations, expressions, knowledge, and skills. This is the aim of UNESCO's initiative over the past decade to update the concept of cultural heritage to include immaterial and intangible cultural products. UNESCO's Intangible cultural heritage (ICH) becomes a device for making another layer of global culture visible and searchable across long distances, and an amplifying mechanism for heritage that can allow it to be converted from culture into a knowledge database, and back into culture again. Is this something we can compare to what Lebanese architect Bernard Khoury imagined as a building that would record memories of a place as data, but also demolish its physical matter with each kilobyte or megabyte it records?

Edited together with Nikolaus Hirsch, this first part of a special double issue of *e-flux journal* focusing on architecture invites a number of the field's most audacious and adventurous thinkers to consider how these invisible and intangible forces are rebuilding cities and reformatting space over and above the role that architecture once served. They are not only reducible to data streams and technocratic information pathways, but also convert ethical questions of whose hands do the actual work of building into material expressions of labor markets, economic flows, and colonial memory. They include the passage from the formal domain of building to an informal domain of knowledge in research-based university departments as well as in slums, black markets, shadow networks, and courtrooms alike. How are practicing architects already working to adapt the radical propositions of architecture to build and think in a way that takes this often contradictory information into consideration?

The second issue of "Architecture as Intangible Infrastructure" will be released in September 2015 with essays and contributions from Beatriz Colomina, Bernard Khoury, Hu Fang, Ingo Niermann and Rem Koolhaas, Hans Ulrich Obrist in conversation with Hans Hollein, and others.

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Keller Easterling
IIRS

In internet slang, 3DPD—meaning "three-dimensional pig disgusting"—is used to indicate that the 2D world is superior to the 3D world. The 3D world is lumpy. The friction from gravity and laws restricts individual freedom. There is the problem of having a body. And the light—the blizzard of photons coming from everywhere—is blinding and ugly. It is much more appealingly dark and smooth and pure to dematerialize into information and nurture faith in a digital platform. The internet is arguably a platform worthy of this kind of faith, but there are other platforms that aspire to parallel or even subsume the internet.

One of these, called ethereum, hopes to be the place for negotiating almost every kind of commercial, cultural, social, or legal exchange. In a video with a white-grey background and a centralized diamond-shaped logo, one of its founders, Vitalik Buterin, seems to barely need a body as he looks off-camera describing the ascendance of the platform towards Turing-complete universality.[1] Having discovered the elementary particle upon which nearly every conceivable exchange might be built, ethereum proposes to replace centralized finance, social networking, law, and governance with a multitude of currencies, communication channels, individual contracts, and "decentralized autonomous organizations." Encrypted against both security risk and interference from centralizing censorship, surveillance, or regulation, this massive platform for achieving "consensus" would make contracts into something like the new email.

Buterin acknowledges the persistent historical paradox immanent in all political organizations of the last ten thousand years—the desire for individual freedom versus the need for collective institutions. But he has the solution. Given that "a pure market has no way of paying for" large collective institutions, in an "economic democracy" one can simply choose from thousands of cryptocurrencies like Bitcoin, each of which is devoted to giving residual funds to a specific collective concern.[2] The platform is actually a descendant of Bitcoin in that it also operates as a shared database, but ethereum ascends the organizational hierarchy to swallow Bitcoin, rendering it just another app or currency within its more comprehensive platform. Users may choose a currency that delivers funds to schools or another that funds health, or, its developers joke, a currency that funds mathematicians. What could possibly go wrong?

Ethereum is indebted to Bitcoin in another way as well. For a limited period of time in 2014, one could use Bitcoin to buy "ether"— an ethereum currency further subdivided into smaller denominations called the finney, szabo, shannon, babbage, lovelace, and wei.

> Ether is a necessary element—a fuel—for operating the distributed application software platform we are building: ethereum. Without the requirement of
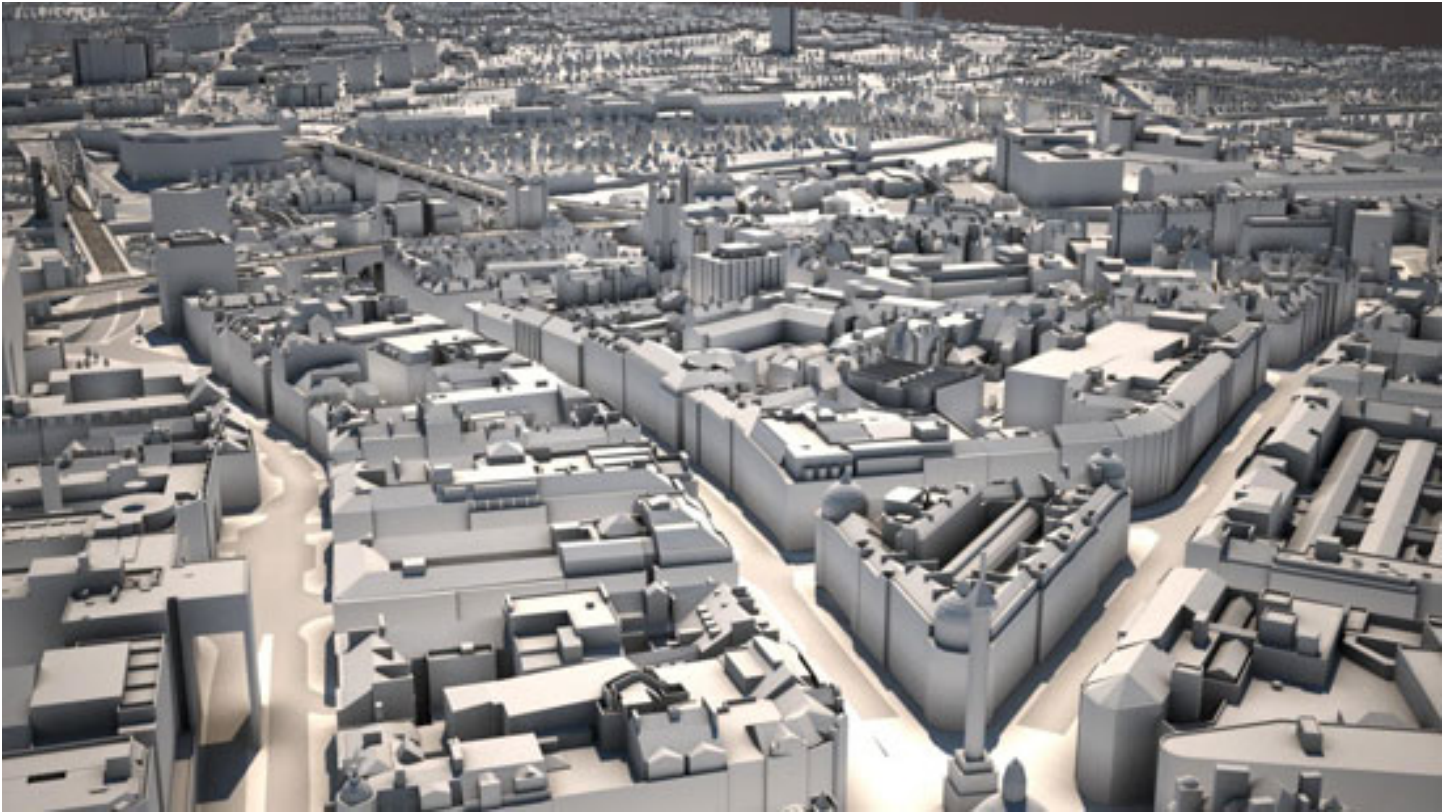
Cities across the world are creating virtual models as a means of assessing the quality of urban living.

payment of ether for every computational step and storage operation within the system, infinite loops or excessive storage demands could bog down ethereum and effectively destroy it.[3]

Buterin asks "what will you build on ethereum?," characterizing it as a neutral plane on which the granular, consequential, and eventually liable constructions will be made. While the messier things will happen later, ethereum itself is as innocent and snowy white as its website and promotional videos, waiting to be freed, exempt from friction, and allowed to unfold on a pure plane providing "universality, simplicity, modularity, agility and non-discrimination." In the "old one and the many" model, ethereum is "the one."

Often the only history lessons the digital entrepreneur wants to hear are those that emphasize how important it is to win and get there first. Still, ethereum prompts a flashback to the Technocracy movement to which it bears at least a cartoon resemblance. Technocrats of the 1920s in several competing factions sought to replace political leaders with a "technate" of engineers who would be better suited to comprehensively collect data with which to rationalize the world's production. The historical counterpart to the "ether" was the "erg," an energy unit currency that would supplant the irrationalities of the price
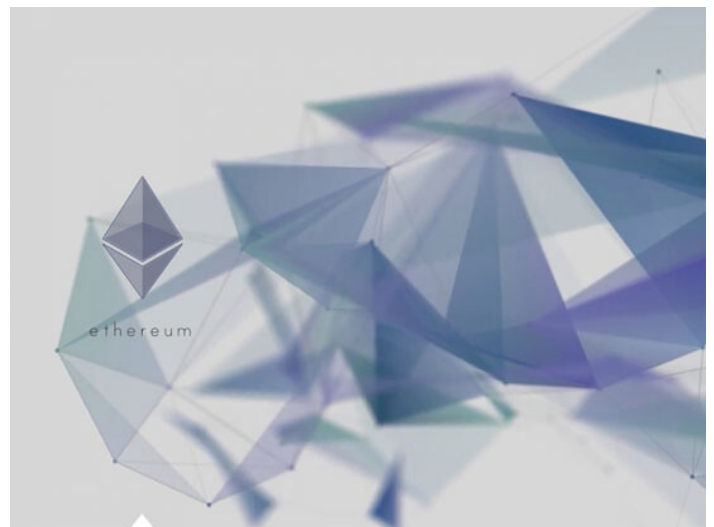
system. Costumed in grey uniforms and black neckties, Technocracy adherents gathered in great assemblies under a circular Technocracy logo. ethereum issues black T-shirts featuring an equally sober and elemental logo and a lowercase "ethereum.com" designed to signal the professed friendliness of open-source liberalism. Technocracy movement sentiments swung between idealistic desires for new, more just ways of managing global resources and clear ambitions for oiligarchic

concentrations of authoritarian power. Similarly, as media curator and theorist Ben Vickers writes:

> The embers of the 1990s rhetoric of cyberstates and pirate utopias are reigniting, signaled by an engineers' call to arms for the wholesale transformation of systems of exchange, interaction, and governance. Yet these uncompromising visions of the future find themselves deeply embedded in the underbelly of Silicon Valley and, in particular, in an unholy trinity of anarcho-libertarian-capitalist technologies.[4]

Historically, the transcendent universal has often dramatized its anxiety about the threat of a lumpy world interfering with its special, exempt, and lubricated status. In an elite, accelerated lane towards perfection, universal dreams are disapproving of impurities that threaten to "bog down" the particular purity or freedom they had in mind. Yet, while the word "universal" wants to be singular, it is often plural. For instance, in the grips of early-twentieth-century modernist thinking, every science, art, or political entity flirted with universals of many different species, modeling for uniformity, homogeneity, modularity, spirituality, or immateriality. Given that each was taking off, sword drawn, in a different direction, collectively they may have created the heterogeneity they despised. But each persistently wished to be singular by supplanting the other. The feverish moderns swore allegiance, above all, to an avant-garde habit of mind that regarded intelligence as successive rather than coexistent; new ideas had to murder old ideas. Even more shrill or hysterical, the dramatic call to arms was used to inflame desires for totalizing political control.

Yet for all their sophistication, primitive organizational and temperamental dispositions often accompany dreams of a universal platform or ultimate technology. Many new platforms suggest that everything will be distributed, ad hoc, individualized and heterogeneous except their own one true monistic platform for exchange which will withdraw into a more transcendent plane of operations. And this essentially monistic disposition, often colored by liberal sentiments of many stripes, can assume a fiercely binary position against any challenger. The sense of a new technological platform as predestined to be the carrier of all of culture's hope for advancement raises the stakes and sharpens the violence of its defense. Despite the potential of information-rich networks, these socio-technical organizations can then oscillate between monistic and binary dispositions that potentially erase or constrict information.

Apart from the content of any argument on any side, consider, as one example, only the temperamental dispositions of symmetrical face-offs between hackers and surveillance. Hackers now, quite rightly, assemble in
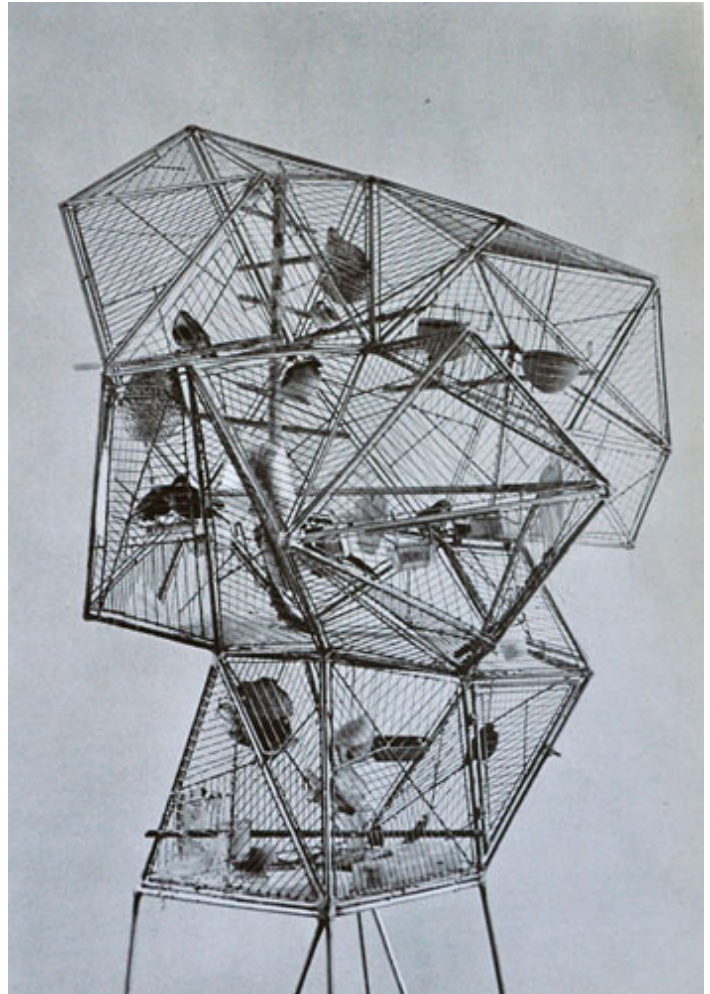
A Constructivist birdcage designed by artist and architect André Bloc.

large numbers with new purpose, standing up to preserve open as well a private exchanges. Surveillance takes a similar stance as victim and martyr as well as warrior. The disposition of the universal that each recognizes naturally becomes more monistic as both sides fortify against intrusion. Both begin to assume binary dispositions with escalating tensions. Both feel justified in spying on the other and encrypting against the other. Both claim violations of rights and freedoms. Both wish to withdraw into greater and greater realms of secrecy even as they retaliate with publicized attacks against each other that flaunt their airtight security or their technical savvy. In this oscillation between monistic and binary dispositions, each side is the control, and each side is the victim; each is offense, and each is defense. What is the dispositional shift that reduces violence in situations where violence itself threatens to restrict information?

Architecture, presumably trained to see the potentials immanent in organizational or structural strata, rarely focuses on these dispositional warning signs, and, picking up an old flag, typically marches to a familiar modernist story. Historically enthusiastic universalists and

technocrats—ringleaders of modernist movements—they have argued for universal laws of proportion, modular systems, abstract formal languages, kits of parts, elemental forms, and redemptive technologies. And when the world resists this purity, they often withdraw into a more perfect, dematerialized, even spiritualized realm of drawing and speculation.
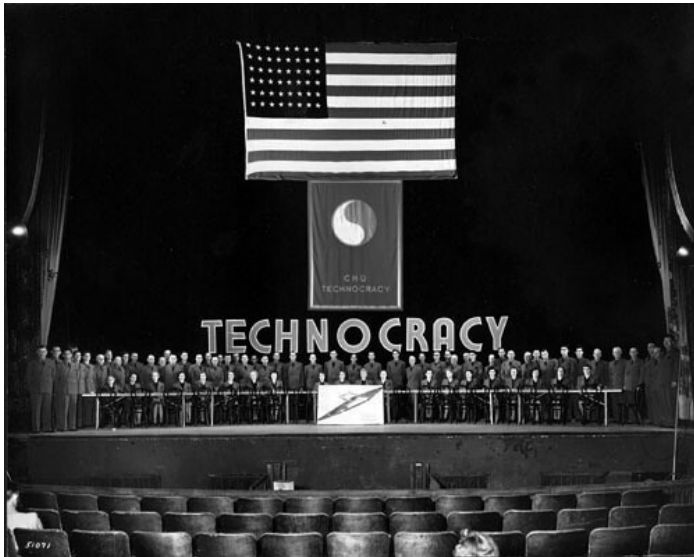
The Technocracy movement, formed in the late 1920s and early 1930s, proposed replacing politicians with scientists and engineers, and opposed acts of political revolution.

Architects still long to be modern like the old days. Having put faith in every successive new technology, believing in the obsolescence of the old and the superiority of the "new," architecture easily flocks toward ubiquitous computing, smart cities, and the "internet of things." Architects have embraced Kevin Kelly's twentieth-century digital enthusiasm about cars as "chips with wheels," airplanes as "chips with wings, farms as chips with soil, houses as chips with inhabitants."[5] OSARC (open source architecture) proposes a universal digital platform for the design and production of space in which, they argue, many of the modernists' dreams can finally be realized. A new technology like Google Car will solve transportation problems. With something like Airbnb, we see tools to make architecture dance to immaterial instructions. New technologies will finally deliver the dematerialization of space into information. The whole world is Turing complete.

Yet, setting aside, even inverting, some default dispositions that attend universal, liberal, technocratic scripts, what previously obscured or sidelined information becomes available? What if there is no one and the many, but only the many? What if there is no quest for an elementary particle or a Turing-complete platform? What if

there is no real desire for liberalism but rather a curiosity about maintaining individual rights through counterbalancing obligation—a fascination not with freedom but with friction? What if there is no primitive separation of mind and body? And might it become tedious to continually herd after another technology with calls for retooling and obsolescence? An alternative habit of mind would value the coexistence of multiple, counterbalancing, contradictory logics, looking not for the next superior subsuming platform but a disposition of interplay between different coexisting platforms of information. Might this ratcheting or reciprocal interplay enrich rather than restrict information?

For architecture this model of interplay potentially offers an especially powerful opportunity when space itself is regarded as a technology and an information system. Rather than instantly, characteristically converting to the next new technology to lead with digital variables, architecture can lead with spatial variables from a platform that tempers the digital at its moment of universal aspiration. Text and code are not the only mediums of information. Information is immanent in the relative positions and potentials of heavy, material spatial arrangements—in the physical matter, whether or not it is digitally enhanced. As cybernetician Gregory Bateson said, "information is a difference that makes a difference."[6] A man, a tree, and an ax, he noted, is an information system. Digital tools are not necessarily needed to make it space-dance and levitate. Given the right points of leverage, the exchanges between spatial variables are quite animated, even if they are only visible in time-lapse.

While architects and urbanists typically design object forms with shape and outline or master plans, sometimes more powerful than designing a thing is developing an interplay between things—active forms that serve as a platform for shaping a stream of objects or a population effect. These are time-released forms for which there can only be dynamic markers and partial control. They might engineer spatial consequence with the nonspatial or intangible variables, though these needn't be digital to be intangible. They can even tune disposition or temperament in organizations—the undeclared or latent potential for productivity or violence in space. Rather than dematerializing into information, perhaps architecture and urbanism have special skills that materialize into information.

Making interplay in a material world calls on artistic faculties that exceed language, mathematical construct, scientific proof, bureaucratic consensus, ideology, or political declaration. These are faculties that are dispositional or less about "knowing that" and more about "knowing how"—a distinction that philosopher Gilbert Ryle used in his arguments against notions of a mind-body split. They often override intellection or rely on a mind that can model potentials in time. Comfortable with heterogeneity, this is correlative mind that knows how to

translate between languages and ranges of information. It is a mind capable of working through a changing, unfinished process for which there can only be dynamic markers. It is a mind like that of a chess master except that the games cannot be rationalized and irrationalities must be modulated improvisationally. It is a mind where confidence games trump game theory—a mind that works with indeterminacy to be practical. One can only "know how" to navigate a river by observing ripples and dimples on the surface, correlate card combinations in poker against the changing faces of the players, feel for the potentials of bread in the dough, land a plane in high wind, sling plaster, hustle, kiss, or tell a joke.
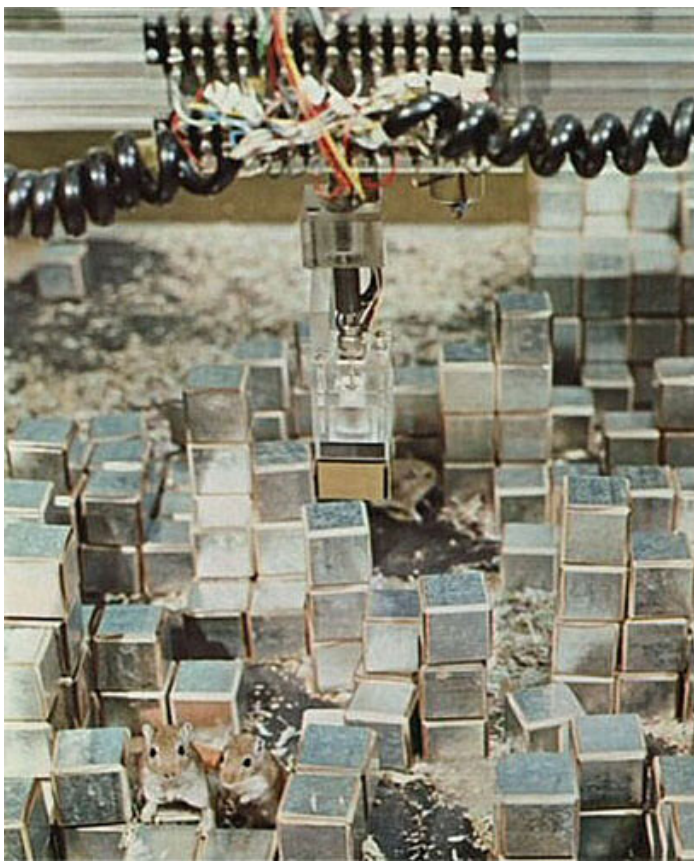
In 1970, MIT's Architecture Machine Group tried to program a robot to respond to unexpected events using an encased environment of blocks inhabited by gerbils. The group also participated in the Jewish Museum's 1970 exhibition Software Technology: Its New Meaning for Art, along with artists Vito Acconci, Hans Haacke, and Nam June Paik, among others.

There are architects who "know how." They have mental faculties that allow them to walk over a field and subsequently draw its topographic map or predict the size of an upstairs bedroom in relation to an interest rate. Hyperaware of multiple levers and faders in urban space, they might think of changing a street by increasing the number of times a train stops there. They can mentally model the way a tax structure will eviscerate a city or the way a toxic building will topple all the buildings around it. Rather than a master plan for a city, they can design a growth protocol with a counterbalancing calculus of public and private space. They imagine collapsing the morphology of airports by reconceptualizing the departure lounge. They adjust the capacities of an entire highway network by altering the repertoire of one switch within it. They initiate a long-term process for organizing the forests and vantage points of a mountain range. They deliberately craft a seductive cultural story or persuasion to have explicit spatial consequences. They change suburban morphology by designing a detail that becomes contagious within a population of houses. Like the comedian who learned to tell jokes to keep his parents from fighting, an architect might even know how to deftly deploy a spatial variable to reduce the violence of binaries or dissipate monistic concentrations of authority—a spatial variable that might fly under the radar of political declaration.

The contemporary production of space intensifies the power of "knowing how" or the art of manipulating active forms within a spatial information system. Unfocusing to see not only buildings but also the almost infrastructural matrix space in which the building is suspended, it is clear that countless repeatable formulas and recipes make the most of the space in the world. Resorts, golf courses, malls, suburbs, retail, and now entire cities like free zones are designed as "spatial products." Currently, McKinsey consultants, World Bank yes-men, financial quants, or management specialists make space as a by-product of econometrics or some other technical apparatus. Space is a secret weapon of the most powerful people on earth, but perhaps a secret best kept from the very people who are trained to make space. But an architect can hack the protocols of the most contagious spatial products. Active forms—things like multipliers, valves, governors, or switches—are the spatial equivalent of code for the heavy bulky world. Rather than object or declaration, they direct spatial processes as carriers of information. The more formulaic this matrix space, the more difficult it is to design object form, but the easier it is to design active form—to exploit the existing multipliers in the matrix with amplifying effects. This matrix that architects regard as the negative space or the unknowable opposite of object form offers not only new aesthetic pleasures but also new political capacities.

Inverting default assumptions, spatial variables frequently determine the shape and resilience of a digital network rather than the other way around. For instance, the Google Car has been widely regarded as the solution to a multitude of transportation issues. The new technology would allow cars to drive in perfect platoons increasing productivity while saving fuel. Yet, one simple but consequential piece of information often missing from these calculations is the size of the car. Automation would

allow users to simulate the driverless convenience of mass transit. But when applied to the standard car it has the opposite of the desired effect. The sheer size of an increased number of cars creates a new form of congestion in the system that might negate all of the proposed gains in speed and efficiency. (The car service Uber has already simulated that effect by putting many more chauffered cars in the system.) Still, urbanists, even those who have long observed other false logics about traffic, are once again attracted to the new redemptive technology. Another solution might start with spatial variables, the sizes and capacities of different forms of transportation in a new interplay or a new set of spaces for switching—upshifting or downshifting between car and mass transit that makes both run more efficiently.

In the new technoscapes of countries like Kenya, large populations of cell phones are potentially changing everything—relationships to work, farm and market, tourism and wilderness. There are plenty of economists, McKinseyites, and bankers on the ground. Development expertise is spoken in languages of business, technology, informatics, and econometrics as it tries to predict the impact of broadband on development—what they call "Development 2.0." There are plenty of new entrepreneurs writing software for billions of cell phones. Entrepreneurs know how to use the cell phone as a multiplier and a carrier of new relationships that have enormous spatial consequences. But the spatial consequences are treated as accidental byproducts of this software. No one is deliberately writing the protocols that start with space in the broadband technoscape. If the constant desired outcome of broadband urbanism is access to information, then the crucial information to access from digital networks is the information of the city. And the information of the city can enhance or constrict the capacities of the digital network. A time-released interplay of counterbalancing forces can protect the balance of power and resources in spaces. In Nairobi, for instance, free-zone incentives can be linked to much-needed transit, benefiting Nairobi while also delivering workers to business. Outside Nairobi, an active form might place broadband and roads in an interdependence. Dialing up broadband that attracts universities and tourism might result in dialing down roads that would disrupt the wilderness and indigenous culture—the information carried in space.

In the wake of the 2008 financial crisis in rustbelt cities and ghost suburbs across the US, the failure was so spectacular that many properties ceased to be mortage products. No longer standing for money, it was as if they returned to a gravitational field. Abandoned by financial institutions, they were adopted by land banks that trade in a parallel market of physical, material assets, reaggregating properties for use by cities and citizens. An architect who "knows how" might see a chance to not only put the development machine into forward but also put it into reverse. Active forms that direct the subtraction or

Rare earth metals are a series of chemical elements found in the Earth's crust that are vital to many modern technologies. The US imports all its Rare earth metals from China.

contraction of development might be very useful in many parts of the world, from distended suburbs to coastal flood plains to sensitive environmental landscapes. These active forms lead with spatial variables that potentially stabilize by also offering more tangible risks and rewards than those offered by complex financial instruments or cryptocurrencies alone.

Every powerful spatial product in the world deploys active forms that are both organizational and narrative. The golf course suburb is a spatial software that puts into interplay things like the cost of fairway improvements with the surface area of the course, because the surface area has yielded enough housing lots to cover the debt. But this organizational active form is paired with a narrative form—like the sponsorship of a guru like Arnold Palmer or Jack Nicklaus. The narrative is like a rumor that enhances all the multipliers within the organization. A consistency between the story and the physical form is paramount to the precise soulful expression of the architect. But in matrix space, the most pervasive and powerful organizations are saying something different from what they are doing. Story and reality are decoupled. Not consistency but rather the ability to manipulate discrepancy is an indispensable skill in matrix space.

In the same way that spatial variables can confound the dominant systems of exchange with alternative markets and variables, they also offer a special kind of political stealth by carrying information not in declaration but in "undeclared" activity. This discrepancy between the declared and undeclared information carried in space challenges some customary approaches to political activism that rely on a righteous declaration of principles. Infrastructure space extends this customary repertoire to include the undeclared, the sneaky, and the evidence treated as inadmissible in master narratives of political theory. This auxiliary activist works on more than "knowing

that"—more than knowing what to righteously oppose—to work on "knowing how" to oppose it. Uncertainty doesn't preclude action. It is the stuff of a more finely grained and stealthy political world where one works with the indeterminate to be not only more practical but also more vigilant (than righteousness). This activist learns that through any combination of new technologies, new spatial softwares, or new persuasions, a snaking chain of moves can worm into an infrastructure space and gradually generate leverage against intractable politics.

Space is currently an underexploited medium of invention, governance, and stealthy or undeclared politics. While a new technology is often seen to repoliticize and rescue an existing technology like space, maybe the opposite is equally powerful. Maybe space, as an alternative platform, offers another kind of information that relieves technologies from the inherent tensions and violence of the universal default. Maybe, as undeclared process, space even offers a trapdoor out of the binaries that result from challenges to the universal in the same way that the least traceable "deep throat" communications are effective against the most intrusive digital surveillance. A habit of mind that values no single dominant platform but the interplay between them is more powerful still. Interplay offers no labels or objects to identify, but rather special skills for reading the practicalities of shaping dispositions with active forms. There is no way of knowing what to do but only how to do it. In addition to 3DPD, maybe there is a need for a variant of IRL ("in real life")—something like IIRS or "information in real space."

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Keller Easterling is an architect and writer from New York City and a professor at Yale University. Her book, *Enduring Innocence: Global Architecture and Its Political Masquerades* (MIT Press, 2005) researches familiar spatial products that have landed in difficult or hyperbolic political situations around the world. A previous book, *Organization Space: Landscapes, Highways and Houses in America* (MIT Press, 1999), applies network theory to a discussion of American infrastructure and development formats. *Subtraction* (Sternberg, 2014) explores unbuilding and demolition as principles of construction. Her most recent book, *Extrastatecraft: The Power of Infrastructure Space* (Verso, 2014) examines global infrastructure networks as a medium of polity. Easterling has lectured and published widely in the United States and internationally. Her research and design work has been most recently exhibited at the Venice Architecture Biennale, 2014, Storefront for Art and Architecture in New York, the Rotterdam Biennale, and the Architectural League. She has also published web installations including: "Extrastatecraft," "Wildcards: A Game of Orgman," and "Highline: Plotting NYC."

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See https://www.youtube.com/w
atch?v=TDGq4aeevgY .

2
See https://www.youtube.com/w
atch?x-yt-cl=84838260&x-yt-ts=1
422327029&v=l9dpjN3Mwps
(20:30).

3
See https://www.ethereum.org/.

4
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Information: Secrets and Lies,"
Artforum , December 2014, 298.

5
Kevin Kelly, *New Rules for the
New Economy* (New York:
Penguin Books, 1998), 76.

6
Gregory Bateson, *Steps to an
Ecology of Mind* (Chicago:
University of Chicago Press,
2000), 381, 462, 315, 272, 21.

Pier Vittorio Aureli

Intangible and Concrete: Notes on Architecture and Abstraction

How to reproduce reality within thinking? How to build a set of categories that allow one to comprehend and represent complex social conditions? These were the questions that Marx asked himself when facing the task of describing the reality of capitalistic modes of production. He noted that when abstract things such as money rule the world and define all social relationships, it is hard to separate the abstract from the real, the tangible from the intangible, the concrete from the conceptual. In a different manner, this is also true for architecture and the urban world. The most obvious manifestation of the architecture of the city is solid things, but their coming into being and their functioning is largely dependent on a multitude of abstractions such as design methods, representational conventions (plans and sections, for example), proportions, functions, building codes, measurements, and financial parameters. In confronting this reality, it makes almost no sense to try to discern and separate the "concrete" from the "abstract," since within capitalism the two are so profoundly intertwined that we can speak of a unique condition in which abstraction is concrete and the concrete—even the most physically tangible object—is always an instance of the abstract. Take for example one of the most famous images of modern architecture: Le Corbusier's drawing of the structural skeleton of Maison Dom-ino, a prototype for mass housing where structure was reduced to horizontal slabs and thin columns. In this depiction of a house structure we see two apparently opposing conditions for architecture that, in Adolf Max Vogt's words, are the perfectly pure and the raw real.[1] While the perfectly pure is the structure's bareness, the raw real is its construction system, where Le Corbusier adapts the technology of industrial architecture to the architecture of the house. Within this example we see how abstraction in architecture is inextricably linked to industrial production processes. Here abstraction manifests itself both as a *process* and as a form that makes explicit the conditions of its (industrial) production. "To abstract" comes from the Latin verb *trahere*, which means to pull something essential out from the totality of which it is a part. Abstraction is a process through which man seeks to reach generic frameworks rather than specific solutions. It is precisely for this reason that abstraction is both artificial and deeply *human*, since the capacity to abstract, i.e., to produce *ideas* and *concepts* out of a multitude of empirical facts, is what distinguishes the human from other animal species.[2]

In what follows I would like to define the relationship between abstraction and architecture, avoiding the trap of identifying abstraction as a style. In order to do so, I'll first define abstraction as a concept and condition that is at the core of capitalist society. Then I will show how fundamental paradigms of architectural culture—such as the rise of design as a practice distinct from building, the invention of perspective, and the discourse on urbanization—can be seen as the embodiment of the impact of abstraction on the world. Only by understanding the historical premises of the rise of abstraction as the

prevalent form of experience in capitalist civilization and its impact on architectural and urban form will it be possible to construct an idea of architecture that is both adequate to and critical of abstraction as the historical condition in which we dwell.
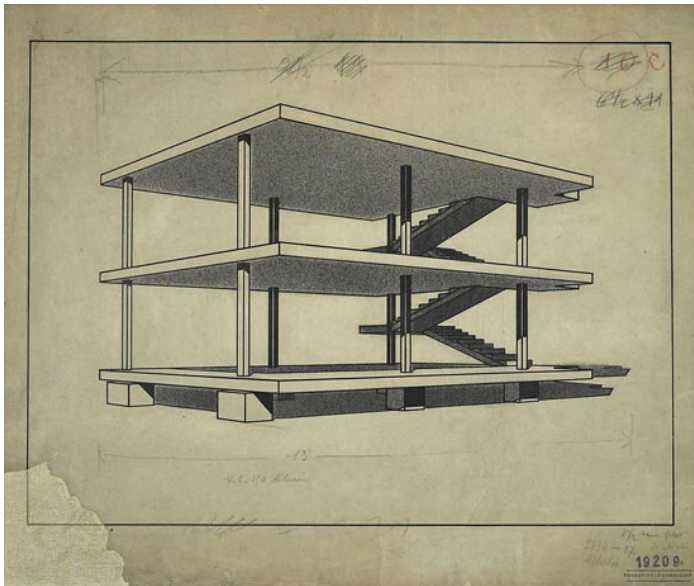
Le Corbusier, Maison Dom-Ino, 1914. Unrealized project.

1.

Coming to terms with abstraction was one of the most methodologically pressing issues for Marx.[3] Following Hegel, he was convinced that the correct methodology for grasping concrete reality was to go from the abstract to the concrete. For Marx, reality could only be recomposed within thought by taking seriously the most general and simple abstractions as the real embodiments of the concrete. Abstractions are thus for Marx not an *a priori* category but the end result of analyzing the concrete, even though they are the starting point for any attempt to give a precise representation of the world. As such, abstractions dissolve the traditional antinomy between the concrete and the abstract, the tangible and the intangible, since abstractions are *concrete*. For Marx, an example of concrete abstraction is the notion of labor not as a specific activity, but as *labor in general*. Marx noted that Adam Smith was able to discover labor as a general *abstract* category as wealth-creating activity because with the advent of industrialization, labor was reduced to its bare features, stripped of the individuality of the worker. Unlike the physiocratic economists who identified labor with agricultural labor, for Smith labor *as such* was not reducible to any activity such as manufacture, agriculture, or commerce. However, while Smith hypostatized the category of labor as such, i.e., as a timeless category that would have been applicable throughout the entire course

of history, Marx understood that labor as a general category could only exist as the result of the historical development of capitalism. As Marx wrote: "As a rule, the most general abstractions arise only in the midst of the richest possible concrete development, where one thing appears as common to many, to all."[4] In an advanced capitalist society, *reasoning*—that is, the recomposition of a multiplicity of things and events within a coherent "scientific" system of thought—is not a simple depiction of reality, but what makes reality work. What is interesting to note is that Marx saw abstraction not only as a methodological category but also as form of life under capitalism. Marx arrived at the conclusion that in the most advanced industrial societies—such as the United States in Marx's time—abstraction had become an ethos. As he wrote in a crucial passage of the introduction to the *Grundrisse*:

> On the other side, this abstraction of labour as such is not merely the mental product of a concrete totality of labours. Indifference towards specific labours corresponds to a form of society in which individuals can with ease transfer from one labour to another, and where the specific kind is a matter of chance for them, hence of indifference. Not only the category, labour, but labour in reality has here become the means of creating wealth in general, and has ceased to be organically linked with particular individuals in any specific form. Such a state of affairs is at its most developed in the most modern form of existence of bourgeois society—in the United States. Here, then, for the first time, the point of departure of modern economics, namely the abstraction of the category "labour," "labour as such," labour pure and simple, becomes true in practice.[5]

From this passage it is clear that Marx understood abstraction as the product of historical circumstances in which the exploitation of human labor on a vast scale became the fundamental objective of the economic process. And yet what makes labor as such abstract is the fact that not only labor in general is the synthesis of the myriad forms of production, but rather that labor has become a *commodity*, that is, a thing measurable in terms of the ultimate abstract system of universal equivalence: money. Within the history of capitalism the rise of abstraction was triggered precisely by the necessity to make everything that exists measurable according to a system of universal equivalence.

2.

In his seminal book *Intellectual and Manual Labor*, Alfred Sohn-Rethel saw the commodity form of things and
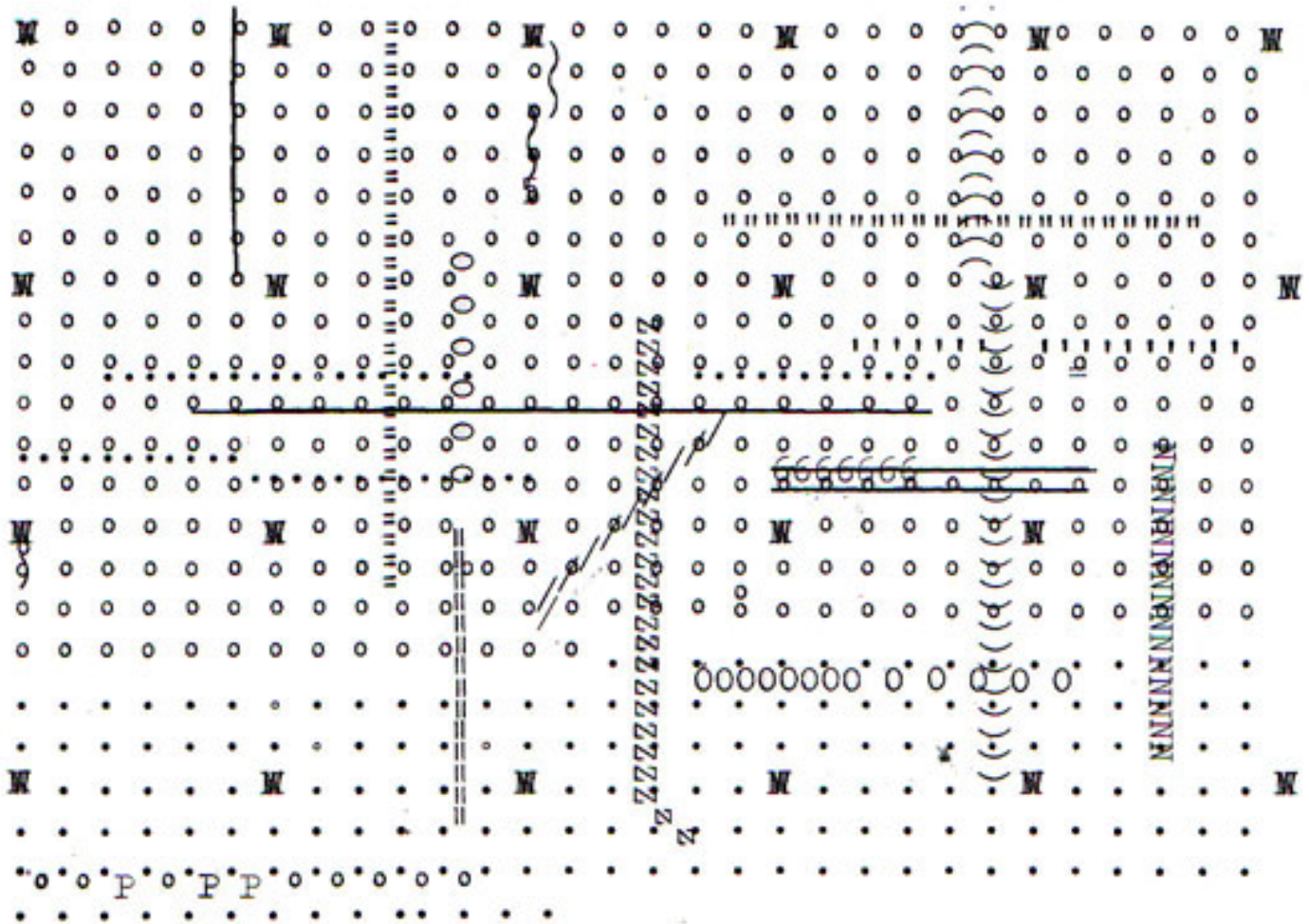
Typewritten plans for Archizoom's No-Stop City, 1969.

persons as one of the fundamental sources of abstraction.[6] While within the condition of *use* time and space are inseparably linked with nature and the material activities of man, within the activity of *exchange* time and space are emptied of their quality and becomes mere quantities that are the measure of value. As Sohn-Rethel notes, within the practice of exchange, where commodities travel great distances and their temporality is suspended while being exchanged, space and time become completely homogenous and continuous in order to not upset the exchange equation. As Sohn-Rethel writes:

Time and space rendered abstract under the impact of commodity exchange are marked by homogeneity, continuity and emptiness of all natural and material content, visible or invisible (e.g. air). The exchange abstraction excludes everything that makes up history, human and even natural history. The entire empirical reality of facts, events and description by which one moment and locality of time and space is distinguishable from another is wiped out. Time and space assume thereby that character of absolute historical timelessness and universality which must mark the exchange abstraction as a whole and each of its features.[7]

For Sohn-Rethel the proliferation of practices of exchange was the result of cognitive abstractions such as mathematics, measurement, and geometry. A commodity as a thing or a person cannot be changed in terms of shape or consistency. However, when a commodity is sold and bought, it must adhere to a system of equivalence—that is, the monetary system within which all commodities can be exchanged.[8] For this reason and according to Sohn-Rethel, the form of commodities is abstract, and abstractness is the character of the economic process that produces the commodity form. Starting in the fourteenth century, the practice of exchange imposed a radically different way of

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Egyptian "stretchers of the rope" pictured in the tomb of Menna, Luxor (1200 BC).

experiencing the world through the lens of *abstract knowledge*. Sohn-Rethel identifies the rise of abstract knowledge as the cause for the separation between manual and intellectual labor, since the latter becomes decisive in establishing all the scientific parameters for production and exchange. From Sohn-Rethel's perspective, Marx was unable to link the abstract form of the commodity as it emerged from the apparatus of exchange and the theory of knowledge that produced all cognitive abstractions necessary for exchange to work. It is for this reason that Sohn-Rethel traces the division of mental and manual labor back to its earliest manifestation in history; he refers, for example, to Herodotus's account of the origin of the discipline of geometry in ancient Egypt, which emerged with the professional practice of the "stretcher of the rope." This practice, in which rope was used to make the measurements necessary for building temples and granaries, found a significant application in parceling out the soil when it reemerged after the yearly Nile floods. It is within this context that the fundamental problems of geometry were defined, such as the tripartition of angles and the magnification and diminution of volumes, including the doubling of cubes. For Sohn-Rethel, meticulous calendars or even astronomy are stripped of their religious aura when we understand how they were instrumental in empowering the measuring prerogatives of the ruling class, made of state functionaries and priests. With the rise of private property and the possibility of exchanging products for money, the abstractness of geometry and mathematics became a ubiquitous social force. However, while in antiquity this social force was limited to the exchange of commodities as objects, with the rise of modernity the abstraction of exchange and the equivalence of value begin to include human labor, since the latter is no longer slave labor devoid of wage, but rather becomes sold and purchased as a commodity among "free" citizens. Here, labor is no longer based on direct material interchange; it depends on capital. It is at this point that labor becomes what Marx defined as *abstract labor*.
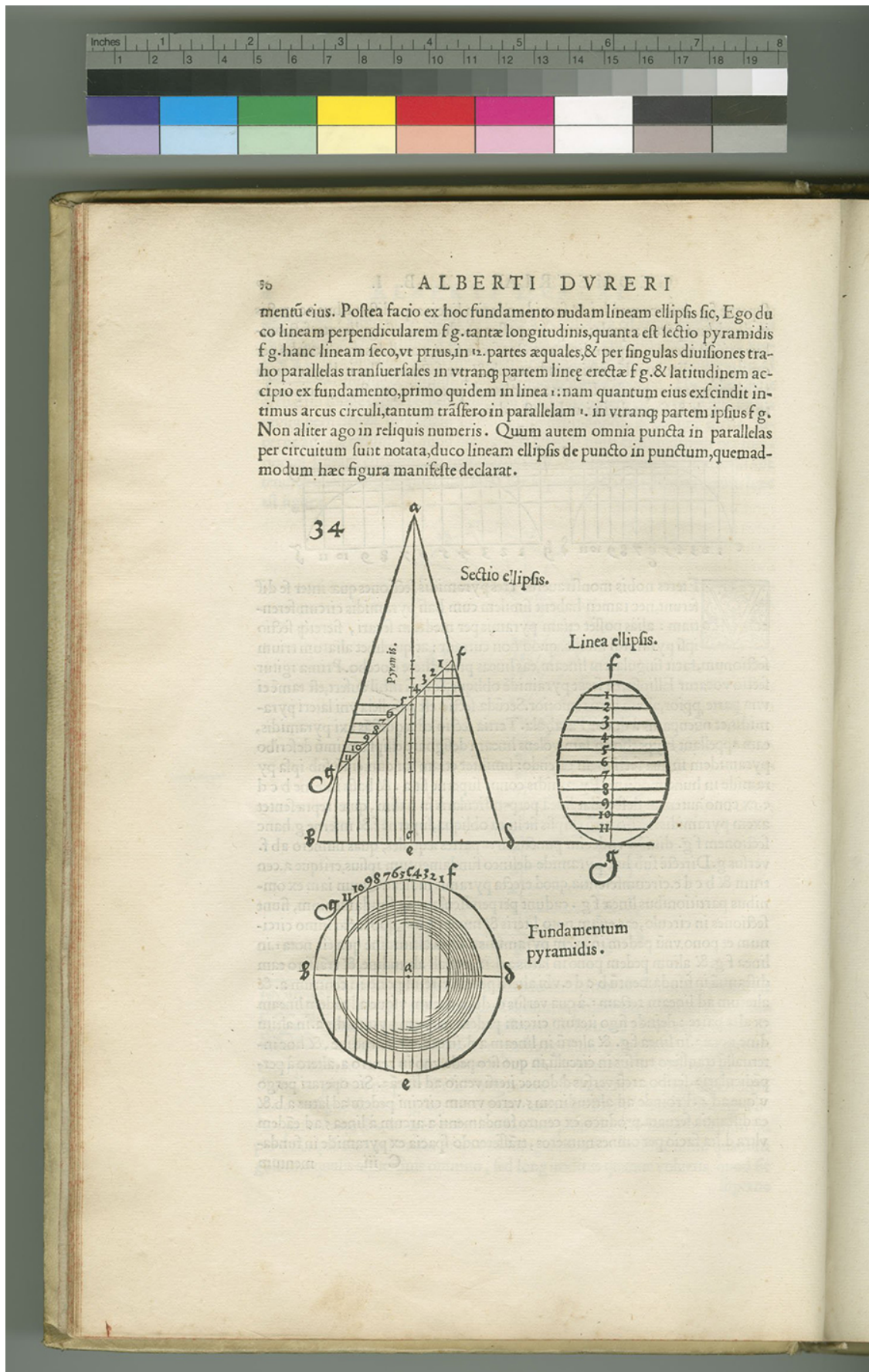
As such, a fundamental result of the advent of abstract labor is the transition from artisanal to industrial labor. While artisanal workers mastered their production by
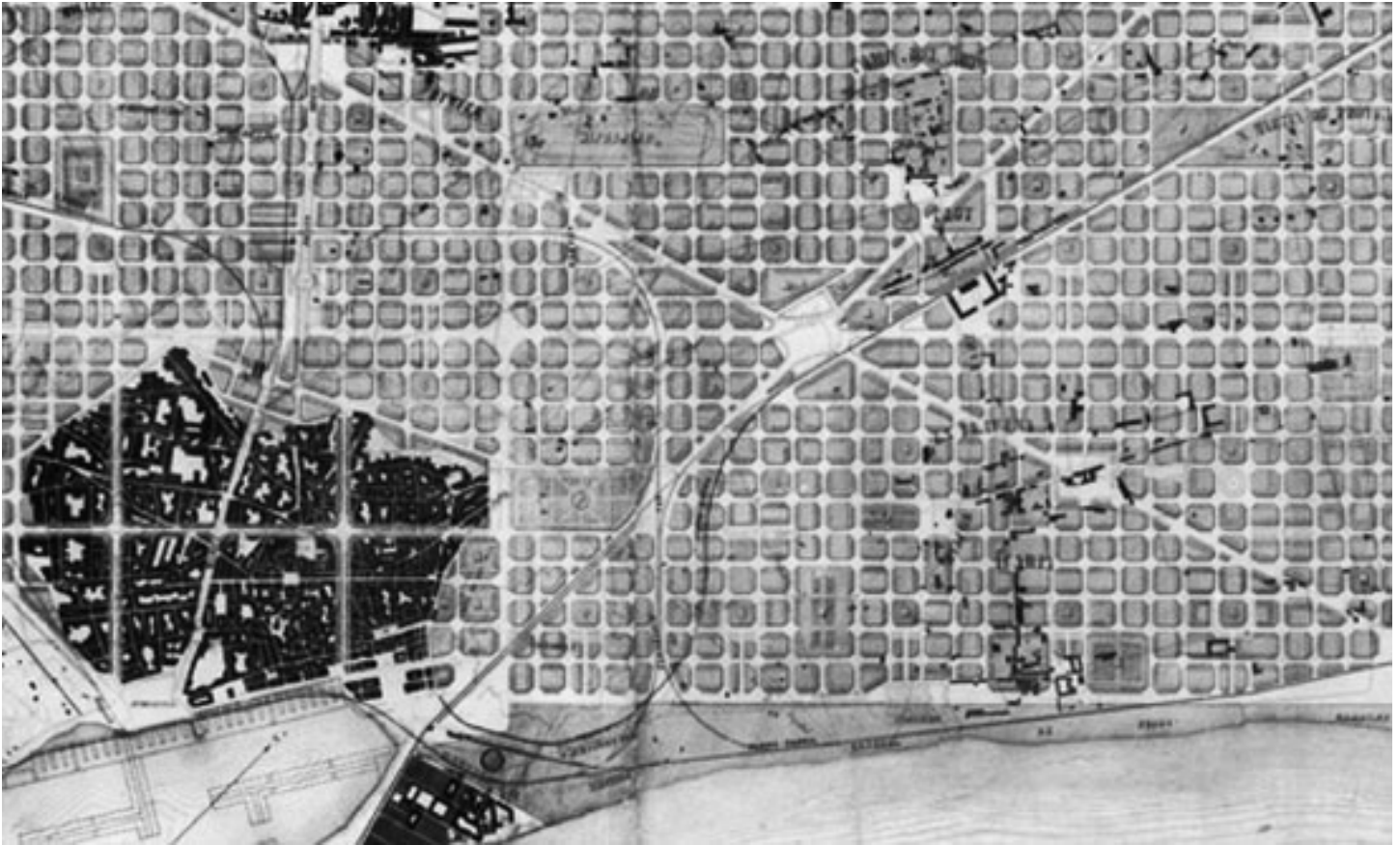
practical know-how and the expertise of their hands, the industrial worker relies instead on the means of production as technology and calculus become crucial. Here we see the raison d'être of abstraction as a way to further the division of labor. Furthermore, the affirmation of abstract knowledge as the motor of capitalistic production was not limited to economy, but also brought to the foreground a new form of life in which abstraction became the basis of experiencing the world. It is precisely at this juncture that we see the rise of architecture as a project practiced by a new specialized professional: the architect. Of course, the passage from the builder as artisan to the architect as intellectual professional whose body of knowledge is closer to the liberal arts than it is to handicraft is not so clear-cut. Filippo Brunelleschi, arguably the first "architect" to practice as a freelance professional outside the guild of carpenters and builders, was a goldsmith, and his approach to architecture was deeply rooted in his artisan know-how. His profound knowledge of mathematics and his disregard for the builders' decision-making capacities in the execution of his designs made him an exemplary case in the formation of architecture as a discipline clearly distinguished from the practice of building, which in its turn is henceforth relegated to the execution of the architect's project.[9]

Vitruvius already outlined the difference between architecture as a project and architecture as building practice when he proposed the distinction between *fabrica* and *ratiocinatio*: fabrica refers to the practice of building; ratiocinatio refers to *reasoning*, the *conception* of the building before it is realized.[10] Through the importance of a form of reasoning in which geometry, calculus, economics, and the management of resources play an important role, abstraction becomes concrete within architectural form. Form is no longer the outcome of individual craft, but the result of a socialized "intellectual" knowledge made of abstract conventions—such as the use of projections and precise systems of measurement.

It is interesting to note that Sohn-Rethel addresses the theoretical work of the German artist Albrecht Dürer as a paradoxical manifestation of the importance of intellectual labor in the exchange economy of early capitalism.[11] Dürer was not an architect, but his theoretical interests, especially in the fields of measurement, perspective, and military engineering, pervaded the design culture of the early Renaissance. Dürer's book *Instructions for Measuring with Compass and Ruler* is the first book on mathematics written by a non-mathematician for non-mathematicians, who in Dürer's mind would have been goldsmiths, carpenters, painters, sculptors, and even architects.

Unlike Brunelleschi, who was secretive about his techniques and plans, Dürer wanted to instruct craftsmen on how to draw complex geometrical figures using the most advanced mathematics. Dürer's effort was focused

Page 30 from the Latin translation of the Treatise on Mensuration by Albrecht Dürer (1538) illustrates the construction of an ellipse.

Detail of the expansion plan for Barcelona proposed by Ildefonso Cerdá in 1859.

on keeping the unity of head and hand by encouraging artisans to benefit from mathematical knowledge without becoming mathematical brainworkers themselves. But, as Sohn-Rethel notes, this project failed. Dürer's "social utopia" of empowering artisans so that they could remain independent producers clashed with the difficulty craftsmen and artists inevitably found in learning a body of knowledge whose sophistication was more appropriate for scientists such as Galileo than for artists like Michelangelo or Titian. As Bernard Cache has observed, Dürer's *Instructions* is a treatise made up not of theoretical propositions, but of procedures, i.e., algorithms illustrated by geometrical figures.[12] By virtue of their resolute abstraction, these procedures could be applied to myriad cases by a multitude of makers. *Instructions for Measuring with Compass and Ruler* is thus the clearest example of the extent to which, at the turn of the sixteenth century, the act of design not only involved a knowledge that went far beyond the object-oriented craft of traditional artisanal culture, but also became an abstract scientific knowledge whose procedures were independent from specific applications. It is precisely within this abstract knowledge—in which mathematics plays a fundamental role as the nexus of many different know-hows—that one of the most powerful abstractions of our civilization took shape, one in which the universe of exchange value found its translation in the way we *see* and quantify space:

perspective.

3.

Brunelleschi is traditionally credited with introducing mathematically constructed perspective within the realm of visual arts. His demonstration consisted in paintings depicting, with striking perspectival effect, the two most important public buildings of Florence in his time: the baptistery and the Palazzo Pubblico, the town hall of the city. However, these paintings were not meant to hang on a wall, but to be seen in the same place from which the buildings had been painted. Brunelleschi made a hole in the paintings at the exact position of the perspective's vanishing point, thus allowing the viewer to see the paintings through the hole reflected in a mirror placed in front of them. Once the mirror was removed, the viewer was able to appreciate the correspondence between the painted version of the building and the building itself. What was crucial in this demonstration was not how a painted image was similar to the painted object in reality, but the fact that the resemblance between the painted baptistery and the real one could be rigorously mathematically constructed. In other words, the striking perspectival effect of the picture was obtained by measuring the exact dimensions of the baptistery and the surrounding

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buildings and then using these measurements as the basis for the perspective itself. Brunelleschi's demonstration shows how perspective is not simply the representation of three-dimensional space, but rather a mathematical construction that implies the possibility of making three-dimensional space itself measurable. Indeed, the most common diagram of perspectival view is an isotropic grid whose vanishing lines render space as a geometrically measurable entity. By making the entirety of infinite space measurable, perspective allowed the architect to control not only solid bodies in themselves but also the space around them.
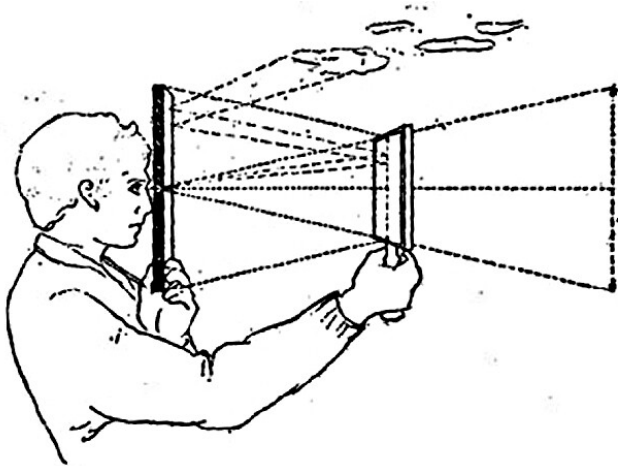

Brunelleschi sought to demonstrate his perspective method through a comparison in situ of a painting and the building it depicts.

In his famous essay *Perspective as a Symbolic Form,* Erwin Panofsky argues that perspectival view is essentially a style of vision whose goal is to approximate the natural view of spaces and things. At the same time, he recognizes that perspective is a highly constructed way to see, which has little to do with our eyesight.[13] Perspective is thus a system within which perception is no longer understood as the realm of fleeting impressions, but as the possibility of a fixed and shareable knowledge of things.

It is for this reason that perspective must be viewed not simply as a technique, but as an epistemological framework in which the act of seeing the world is reinvented on a scientific basis. And yet for such a system to work, it needs to reduce the experience of space to the abstraction of *mathematical* space. This is the ultimate paradox of perspective: on the one hand, it is intended as a veridical representation of space as it is seen by the human eye; on the other, it is a construction whose principle is to exclude the accidents of seeing, to reduce the gaze to the certitude of a repeatable formula. Indeed, perspective can be seen not so much as an innovation in terms of representation, but as a revolution in the

conception of space. Hans Belting has noted how the rise of mathematically constructed perspective in Florence at the beginning of the fifteenth century was linked to the theory of mathematical space introduced by fourteenth-century mathematician, philosopher, and astrologer Biagio Pelacani.[14] For Pelacani, geometry and mathematics were the only means through which it was possible to reach the highest degree of certainty about objects in space. What mattered in the definition of real objects in space was the possibility of quantifying the distance between them. Thus, in Pelacani's mathematical space, once the measurement of an object was known it was possible to measure other nearby objects and the space between them. Here perspective acts as a projective geometry that links the totality of space within one commensurable system. Before the Renaissance, empty space was considered a vacuum, a lacuna which, precisely because of its intangibility and incommensurability, could not be grasped. With Pelacani's mathematical space, empty space is no longer an incommensurable reality, external to the world of physical objects, but a quantifiable space that measures the objects it contains. Such empty space is both real, because it allows viewers to locate their position in space, but also abstract, because it is constructed according to mathematical relationships.

The impact of perspectival space went far beyond the abstraction of mathematics; it took the form of physical space itself. The regularization of urban space according to geometrical principles that started in the fifteenth century is unthinkable without the influence of perspectival view.[15] The use of mathematically constructed perspective was necessary for measuring and planning vast regular spaces. Architecture itself began to be imagined as a perspectival framework in which sequences of elements, such as columns and arches, could physically embody a unifying, homogenous, and thus systemic space. The architecture of Brunelleschi is a paradigmatic example of how the abstraction of perspective became architecture. Unlike medieval and gothic architecture, Brunelleschi's architecture is radically syntactical.[16] As is well known, Brunelleschi's innovative architectural language consisted in the "rational" coordination of the building parts within a coherent whole. The instrument of such coordination was the systematic use of columns and arches (the latter always inscribed within a half-square). In this way Brunelleschi introduced an architectural language in which every building was dominated by an overall *disegno*. For example, in the Ospedale degli Innocenti the entire complex is determined by the module exhibited in the loggia facing the piazza. Brunelleschi's use of standardized decorative elements, made of the grey "abstract" color of *pietra serena,* deprived the builders of their artistic autonomy by rejecting their interpretation of decorative elements in favor of a total design controlled by the architect. Brunelleschi, who was familiar with examples of ancient Roman architecture, took from them the possibility of a

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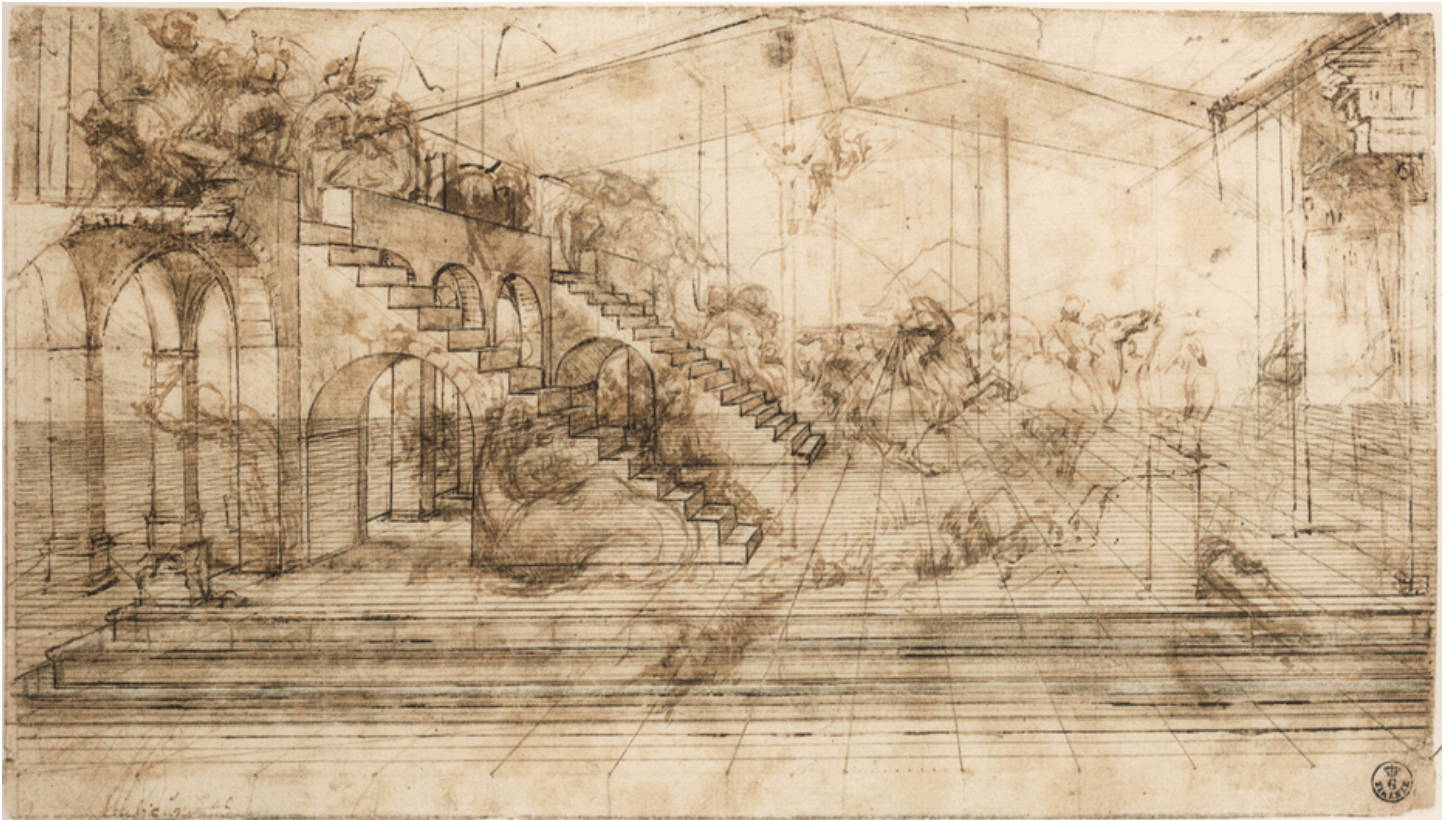
Leonardo da Vinci, Study for The Adoration of the Magi, 1481.

design method. Yet Roman architecture was not in itself as systematic as Brunelleschi understood it to be. Apart from crucial buildings such as the Coliseum, which shows a coherent stacking of different orders, the ruins of ancient Roman architecture demonstrate a much greater variety, irreducible to the grammar of the "classical" orders. Brunelleschi's architectural language is instead based on a strict modularity within which ornament becomes a device used to visually confirm the relationship between each element and the whole system. In Brunelleschi's idea of architecture, the building is no longer a singular and finite artifact, but a system that can expand ad infinitum.

It is precisely the infinity of this system that best embodies the logic of perspective as potentially homogeneous and coherent space in which everything is commensurable. And it is precisely this *commensurability* that allows perspective to become the spatial embodiment of a world dominated by the equivalence of exchange value. It is not by chance that mathematically constructed perspective was invented in Florence: throughout the twelfth and fifteenth centuries the city developed as one of the most economically advanced cities in the Western world, with merchants and especially bankers playing a decisive role. In this context, advancements were triggered in calculus and mathematics. As Sohn-Rethel notes: "Capital and mathematics correlate: the one wields its influence in the fields of economy, the other rules the intellectual powers of social production."[17]

If the abstraction of perspective postulated a world that could be measured through calculus and proportional relationships, the concept of urbanization reduces the world to the abstraction of data and information, such as population growth and the maps through which we orientate ourselves. This abstraction does not remain "virtual" but becomes concrete in what the painter Peter Halley has described as the modern city: an omnipresent unfolding of geometric structures, such as houses and transportation, in which human life is channeled, measured, and reproduced.[18]

In 1867—the same year Marx published the first volume of *Capital*—Spanish engineer Ildefonso Cerdà published the seminal, although overlooked, *General Theory of Urbanization*, in which he attempted to define a new conceptual framework for city building.[19] However, Cerdà's theory was not just an urban design manual, but rather an epistemological enquiry whose aim was to redefine what until then was still referred to as the "city."

The core of Cerdà's theory was the coinage of a new term: the neologism *urbanizacion*, from the Latin word *urbe*. In ancient Rome the *urbe* was the city, but contrary to the definition of the city as *civitas*, which referred to the city as a political institution (made of *civis*, the citizens), *urbe* defined the city as material organization made of buildings and infrastructures whose goal was similar to that of domestic space: to sustain the lives of its

A detail of Brunelleschi's Portico of the Ospedale degli Innocenti exemplifies his use of repeated modules.

inhabitants. In a crucial passage, Cerdà describes urbanization as a condition of limitlessness and the total integration of movement and communication, as a "vast swirling ocean of persons, of things, of interest of every sort, of a thousand diverse elements" that work in permanent reciprocity and thus form a totality that is uncontainable by any previous finite territorial formations such as the old walled city.[20] For Cerdà, the urban condition implied a completely new way of designing the city, which was no longer *only* about the form of buildings and spaces, but also about the whole functioning of the city as a large-scale infrastructural system. Such a new design would involve the use of statistical data, diagrams of circulation, mappings of natural resources—in short, all kinds of information that would provide a comprehensive knowledge of human dwelling beyond the physical evidence of the city as built form.

Cerdà wrote his general theory after designing the expansion of Barcelona in 1859. The expansion envisioned by Cerdà consisted in a grid through which an even redistribution of social wealth would become possible. A key element in Cerdà's project was the unprecedented use of statistical data as a support for the project. The grid was thus not only a form, but a system in which housing, circulation, and the location of facilities would be planned as one system. It was precisely his work on Barcelona that compelled Cerdà to theorize the city beyond the opposition between contents (circulation, trade, and people's vital necessities) and container (architecture and infrastructure). Cerdà introduced a concept related to the *material* reality of the city that was not reducible to a material object such as a building or a road. Like capital or labor as described by Marx, the urban for Cerdà is a *condition*, not a thing, which influences everything and transcends the difference between what is material and what is immaterial. The urban is a multifarious ensemble

of relationships that escapes any attempt to crystallize them into a finite object. Cerdà's theory is a de facto definition of urbanization as a totalizing governmental machine within which the city as a discernable political form is subsumed by an ever-expanding logistical, normative, and juridical apparatus whose ultimate materialization is the infinite grid of circulation.[21]

With his *General Theory of Urbanization*, Cerdà introduced into the discourse on the city and its project a new epistemology whose object of enquiry was of a paradoxical nature: the urban is both *intangible* and *concrete*. It is intangible because its nature cannot be reduced to a physical entity. And it is concrete because the urban always affect and alter the physical condition of things. A building, a bridge, a road, and even a person are not urban in themselves, but the urban condition informs each of these elements and makes them work within a totalizing system. If we follow this definition of the urban as an abstraction that becomes real in its multifarious way of working, we come very close to the very nature of industrial labor. The urban condition as described by Cerdà arises from the necessity of keeping people alive and thus productive. The governance of life—what Michel Foucault called biopolitics—became strategic at the moment when the extraction of surplus value from labor power became the main priority of capitalism. While Cerdà viewed urbanization optimistically, as a condition in which the limitless development of technology would create a harmonic cosmopolitan unity based on the even redistribution of wealth, today it is clear, if not banal, that urbanization has contributed to the commodification of everything that exists in the world. Cerdà wanted to give to urbanization its true face as a form with no form, deprived of all the symbols and meanings of the traditional city. In contemporary urbanization, a plethora of symbols and meanings has become the generic curtain behind which the abstraction of capital operates. It is for this reason that the task of the coming architecture is not simply to unmask the undeniable abstraction of architecture as a process, but to make legible a form of architecture in which the awareness of the conditions in which we dwell can become the precondition for new forms of life within and against the power of abstraction.

X

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1
Adolf Max Vogt, *Le Corbusier, the Noble Savage: Toward an Archaeology of Modernism* , trans. Radka Donnell (Cambridge: MIT Press, 1998), 24.

2
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3
Marx discussed the issue of abstraction most notably in his introduction to the *Grundrisse*. See Karl Marx, *Grundrisse: Foundations of the Critique of Political Economy* (London: Penguin Classics, 1993), 81–114.

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Ibid., 104.

5
Ibid., 104.

6
Alfred Sohn-Rethel, *Intellectual and Manual Labor: A Critique of Epistemology* (London: The MacMillan Press, 1978).

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Ibid., 35.

8
Ibid., 36.

9
See: Mario Carpo, The Alphabet and the Algorithm (Cambridge: MIT Press, 2011). See also: Sergio Rossi, Dalle botteghe alla accademie. Realtà sociale e teorie artistiche a Firenze dal XIV al XVI secolo (Milan: Feltrinelli, 1980), 54–73.

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11
Ibid. 113–16.

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Bernard Cache, lecture delivered at Environment Review Days, April 10–12, 2013, a conference focusing on the theme of "The Project." Arranged by the Strong Research Environment Architecture in the Making, Stockholm School of Architecture.

13
Erwin Panofsky, *Perspective as Symbolic Form* , trans. Christopher Wood (New York: Zone Books, 1991), 31.

14
Hans Belting, *Florence and Baghdad: Renaissance Art and Arab Science* (Cambridge, MA: Belknap Press, 2011), 150–62.

15
Far from being an invention of the fifteenth century, perspective in the form of mathematically quantifiable space was already at work in the design of Florence major public spaces. See Marvin Trachtenberg, *Dominion of the Eye: Urbanism, Art, and Power in Early Modern Florence* (New York: Cambridge University Press, 1999)

16
See Arnaldo Bruschi, "Considerazioni sulla 'maniera matura' del Brunelleschi in Arnaldo Bruschi, *L'antico, la tradizione, il moderno da Arnolfo a Peruzzi, saggi sull'architettura del Rinascimento* (Firenze: Electa, 2004), 87–122.

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Sohn-Rethel, *Intellectual and Manual Labor* ,45.

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Peter Halley, "The Crisis in Geometry," *Arts Magazine*, vol. 58, no. 10 (June 1984): 20–24.

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Ildefonso Cerdà, *Cerdà: The Five Bases of the General Theory of Urbanization* , ed. Arturo Soria y Puig (Madrid: Electa, 2000).

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See Ross Exo Adams, "The Burden of the Present: On The Concept of Urbanization," *Society and Space* https://www.societyandspace.org/articles/the-burden-of-the-present-on-the-concept-of-urbanisation .

Justin McGuirk

Honeywell, I'm Home! The Internet of Things and the New Domestic Landscape

In 1972, as part of MoMA's exhibition "Italy: The New Domestic Landscape," the Radical Design group Superstudio installed a small cubic room with mirrored walls that appeared to replicate itself into infinity. The group's proposal, submitted to the curator Emilio Ambasz, had taken the form of a one-page statement describing exactly how this "microenvironment" should be installed, followed by a further nine typed pages of theoretical exposition by Superstudio's cofounder Adolfo Natalini. In those nine pages—a manifesto of sorts, veering off into prose poems and short stories—Natalini outlines a new way of living. The attributes of this hypothetical existence include "permanent nomadism," "life without objects," and "life without work." These conditions are made possible by a mysterious gridded structure that Natalini refers to only as "the network."

It is only too easy to root around in the archives, extract something highly selective, and proclaim this or that radical to have been prophetic. In this case, however, Natalini's vision appears uncannily prescient. Of course, "the network" of his imagination was simply an act of wish fulfillment—he hadn't the slightest idea what it was exactly (although, by coincidence, 1972 was also the year that ARPANET was first demonstrated in public), he knew only that it was a "total system of communication." In Superstudio's photo-collages, it took the form of a grid—either an abstract gridded plane or a gridded megastructure called *The Continuous Monument*. Theirs was only a mock utopia, serving to critique both modernism and consumerism, and yet, ineluctably, the network came to pass. It is not, however, a megastructure. In fact, for all intents and purposes—for the majority who cannot see the server farms and the undersea cables—it is invisible.

The effects of the network age on urban life in the early twenty-first century are roughly as Natalini predicted, if less utopian. Immaterial labor has led to a flexible but precarious existence in which, for the young at least, "permanent nomadism" is not so far from the truth. Objects, meanwhile, are dematerializing into live streams, downloads, e-books, smartphone apps, and the so-called "sharing economy." We have witnessed the primacy of software over hardware.

Most significantly, what we think of as "domestic space" is being completely redefined. We need look no further than the rise and rise of Airbnb. The rental website epitomizes a new era of nomadic, vicarious living, in which one can simply slip into different lifestyles like dresses. Its evangelists proclaim a utopian mission of sharing over owning (CEO Brian Chesky famously claims not to own a home), and like good neo-Marxists they talk of use-value rather than exchange-value. But of course Airbnb enables a global population to be part of the rentier class. It is as much a symptom of precarity as of networked living—it is the means by which many now pay their own rents and mortgages. Airbnb is what we have instead of

Superstudio, The Continuous Monument: On the Rocky Coast, project Perspective (1969). Collage.

state-subsidized affordable housing, and it is leading to the wholesale commodification of domestic space.

For the first time since the mid-twentieth century—with its labor-saving household appliances and rising quality of life—the domestic is once again the site of radical change. And though domestic space appears to fall within the realm of architecture, architects themselves have been almost mute on the implications of such change. Architecture, it seems, has given up its dreams of imagining how we might live, and so into that void technology is rushing. That tired old trope of "the house of the future" has been replaced by what is now called the "smart home." The smart home is the network's great white hope for ubiquitous connectivity. It sounds benign enough, and may conjure Jacques Tati-style *mise-en-scènes* populated by absurd devices—the smart home is prime territory for farce—but it is also an ideology. It is the house-shaped manifestation of the internet of things, according to which all our devices and appliances will join the network, communicating with us and each other.

To say that the internet of things is an ideology is to suggest that the use-value of the concept has yet to be sold to the consumer. It is easily mocked by skeptical hacks who question the need for talking fridges and washing machines that you can program with your smartphone ("You still need to put the clothes in yourself, right?"). Bruce Sterling argues that the internet of things has nothing to do with the consumer and everything to do with the business interests of the service providers. Given that data is the new currency, the internet of things is an epic power grab by the lords of the network—Sterling focuses on the "big five" of Google, Amazon, Facebook, Apple, and Microsoft—to gain control of as much human data as physically possible.[1] As the primary interface of the internet of things, the smart home is effectively the tendrils of the network rising out of the ground and into

every one of our household appliances to allow mass data collection and digital surveillance.

That, at least, is one interpretation. It goes without saying that the internet of things agenda is being driven by the technology industry with the eager boosterism of the business community, which sees a blizzard of dollar signs. And while the evangelists of the IoT would hardly define themselves in Sterling's terms, neither do they contradict him. As an effusive cover story in the *Harvard Business Review* put it recently, "It is the expanded capabilities of smart, connected products and the data they generate that are ushering in a new era of competition."[2] For better or worse, the smart home is the new New Domestic Landscape.

The question is, what are the implications for architecture? Do these developments have spatial ramifications? Should we plan and build in new ways to accommodate this technological surge, or is it just a case of running a few extra wires into the walls? Can architects continue to design according to age-old principles of good form and sound proportions (or stick to the boilerplate floor plans prescribed by greedy developers, as the case may be)?

The history of architectural historians overlooking the impact of technological innovations is a long one, and its best chronicler was Reyner Banham. In *The Architecture of the Well-Tempered Environment*, he charts the effects of successive environmental revolutions, such as electric lighting and air-conditioning, on built form. Banham's geeky enthusiasm for ducting and electrical services enables him to propose a parallel history of architecture according to which the Royal Victoria Hospital in Belfast (1903), despite its outmoded, castellated styling, was "far more pioneering than anything that had been designed by Walter Gropius" because it was the first building to include a form of air-conditioning.

The trajectory of this parallel history takes in the invention of the suspended ceiling, in the late 1940s, which was required to hide the electrical services once concrete floor slabs had done away with the "dead spaces" in which that messy tangle used to be hidden. Banham can gleefully point out that the advent of the suspended ceiling, now ubiquitous in commercial buildings the world over, passed without comment in architectural literature. And yet it is precisely such technical details that allow for the "Cartesian glass prism" of Le Corbusier's United Nations building in Manhattan—and thereafter the International Style—to exist in the first place.

So are we in danger of overlooking a similar technical detail when it comes to the internet of things and the smart home? After all, before revolutionizing architecture, air-conditioning was slow to catch on (introduced first in factories and then in cinemas, where it was most cost effective). But there is one salient difference. When

air-conditioning finally took off as a domestic revolution, after the Second World War, millions and millions of consumers knew exactly why they wanted it. One cannot yet say the same of the smart home.

Above: Allison and Peter Smithson demonstrate the house of the future in the exhibition "This is Tomorrow," 1956; Below: Smart home panels centralize communication between the internet of things objects. Despite the aesthetic conservatism of this proposed model, the connected home will probably produce a factory surplus metadata on its users.

Just What Is It That Makes Today's Homes So Different, So Unnerving?

The internet-of-things evangelists proclaim that it is that most "disruptive" of phenomena: a paradigm shift. Bearing in mind Banham's assertion that electrification was "the greatest environmental revolution in human history since the domestication of fire," one naturally looks for equivalent consequences when it is claimed (no doubt accurately) that "the network is the new electricity."[3] So just how, exactly, will the internet of things revolutionize domestic life?

The proposals to sell this revolution to the consumer are myriad and many splendored. But perhaps the poster product of this new domestic landscape is the Nest smart thermostat, which not only tells you exactly how much energy you're using but can also learn your energy-use patterns and adjust itself according to your established preferences. The ostensible motive is environmental sustainability—Nest is helping us be better planetary citizens. But of course the reason why Nest was purchased by Google is that its smart thermostat is also a data hoover—a point we shall return to later.

The potential applications of the domestic internet of things cover a whole array of multi-billion-dollar industries, from security and healthcare to lifestyle and gaming. Thus Microsoft is developing kitchen counters that can recognize foodstuffs and display appropriate recipes. There are smart mattresses that monitor your sleep patterns by measuring your breathing and your heart rate. There are any number of smart locks now available that open when you walk up to the door and that can be programmed to let in your friends or guests (perfect for the Airbnb generation). There is cautious excitement about the potential of "ambient assisted living" for the elderly. A University of Manchester research group has developed smart carpeting that can tell when someone has fallen and that can even diagnose potential mobility problems from their footsteps.

Most of these products correspond to Arthur C. Clarke's third law: "Any sufficiently advanced technology is indistinguishable from magic." And it may well be that magic is precisely the quality that will seduce the consumer into embracing a world of all smart mod cons. The world of hyper-performance products, colluding in a domestic ecosystem that we barely understand but that lay its manifest intelligence at our disposal, may be our inevitable destiny. Banham was skeptical about this, averring with amusing bathos that while space capsules may require omni-competence, "here on Earth it will often prove that drawing a blind over a window … is all that is required."[4] More trenchantly, Sterling argues that we the consumer will have little choice in the matter either way. The internet of things is like electrification: if we are even able to opt out, we will simply be routed around and made redundant.

In the meantime, there are various intractable problems to solve. Some of them are technical. For instance, it is widely understood that the effective interconnectivity of all our household devices—their ability to sync and update and communicate with each other—depends on a single unifying platform. All tech companies agree on this and that is why they are all beavering away at solving the problem with *their own proprietary platform* that will not

work with all the others. The idea that all our products may have to be either Apple-compatible or, say, Samsung-compatible, is a disincentive. As for the rapid cycle of updates and obsolescence, well, architects simply do not think in such ephemeral time spans. There are also security concerns: our houses become eminently more hackable the more connected devices we have. Experts evoke a cyber-security nightmare of "botnet" armies using smart toasters to launch DDoS attacks, etc. But let's concern ourselves with the ethical implications of the smart home. Because if we are in the midst of a subtle domestic revolution, its consequences are in new forms of labor, the erosion of privacy, and the monopolization of control.

It is a truism worth restating here that our homes are increasingly the primary sites of production. This is not just true of new flexible labor models that allow many people to work from home; it also applies to the so-called "sharing economy" (read the digital rental economy) that allows us to commodify our private spaces so effortlessly. Already, the idea of the home as a retreat, a sanctuary from work, comes into question. But it is also literally true that our homes are sites of production simply by dint of rising property values. In London, with its 18 percent price rises in recent years, it is quite likely that your home makes more money every year than you do.

Added to this is the fact that the proliferation of smart, connected products will turn the home into a prime data collection node. It is estimated that there will be fifty billion wi-fi-connected devices by 2020, and all of them will collect data that is transmitted to and stored by their manufacturers. In short, the home is becoming a data factory.

Our participation in this process has been underway for some time, not least through social media, which has helped constitute the post-Fordist world in which we no longer fabricate machine parts but subjectivities—opinions, lifestyle choices, our public image. Different theorists come at this from different angles. Zygmunt Bauman calls it the commodification of the self, while Franco "Bifo" Berardi calls it "cognitive labor," which is essentially a labor of communication. It is not hard to extrapolate Berardi's theory of the info-commodity to the smart home. The insidious aspect of the smart home is that even as we go about our lives consciously producing data—as happily tweeting members of the "cognitariat"—we will also produce vast quantities unconsciously. Some of this data will be of use to us—knowing how much energy we are using or knowing on the way home whether there is milk in the fridge—but much of it, especially the metadata, will not. All of it, however, is valuable currency to the producers of those products.

The home, then, becomes an extension of our immaterial labor. It is the producer of metrics. Just as our wearable

tech counts our footsteps, our homes will monitor and measure us in other ways. All of our devices will cooperate in one great collective data harvest. Why is that data useful to the tech companies that own the appliance companies? Because they will use it for consumer profiling, all the better to send you targeted advertising. They will also use it to try and streamline our future customer experiences through predictive analytics—the same tools that allow Amazon and Netflix to suggest that we might want to read more Dave Eggers or watch the new season of Homeland. Our countless daily actions and choices around the house become what define us. As Eggers puts it, "Having a matrix of preferences presented as your essence, as the whole you? ... It was some kind of mirror, but it was incomplete, distorted."[5]

A stock image illustrates cloud computing as being devoid of infrastructure.

"I think you know what the problem is just as well as I do"

The most obvious and often-raised concerns about all of this, of course, have to do with privacy. The mass harvesting of our data and metadata may not be equivalent to inserting CCTV cameras in our homes, but it is a form of digital surveillance. One might ask whether we are returning to the ancient Greek notion of privacy that Hannah Arendt argued was not particularly private. That private realm was neither considered particularly noble. It was only centuries later that private property would offer "the only reliable hiding place from the common public world, not only from everything that goes on in it but also from its very publicity, from being seen and being heard."[6]

Here, the private becomes not exactly public but exposed to other private, corporate entities. The trade-off that the tech companies will offer us in exchange for the smart home is efficiency. And we the consumer will be willing accomplices for the simple reason that we are becoming very used to paying for services with our "free" data—some of these products may even be supplied at

Timo Arnall, Internet Machine, 2014. Video, 6 min 40 sec, digital 4K, 25fps, stereo.

next to no price in return for the data they produce. But there is a fine line between efficiency and control. When Rem Koolhaas interviewed Tony Fadell, the CEO of Nest, at the Venice Biennale in 2014 (Nest was one of the sponsors of Koolhaas's "Elements" exhibition), he suggested that it was a small leap from a thermostat that knows how to save energy to one that proposes that, in fact, you have used enough energy for one day and that it's time for bed.

It's possible that, as a child of the 1960s, Koolhaas was calling on memories of Kubrick's *2001: A Space Odyssey*:

> **Dave Bowman:** Open the pod bay doors, HAL.
> **HAL:** I'm sorry, Dave. I'm afraid I can't do that.
> **Dave Bowman:** What's the problem?
> **HAL:** I think you know what the problem is just as well as I do.

The notion that smart, connected products will lead inevitably to patterns of control has been addressed at some length by the ever-watchful Evgeny Morozov. He calls it "solutionism." In the name of efficient problem solving, we increasingly rely on sensors, apps, and feedback loops, and then these tools are designed to elicit prescribed forms of behavior. He gives the example of

Procter & Gamble's Safe Germ Alarm, a smart soap dispenser used in public toilets in the Philippines. Leaving the stall sets off an alarm that only goes off when you push the soap dispenser. Similarly, there have been various reports of the UK government trying to "nudge" citizens into better behavior through the use of smart devices. A report by Westminster Council called for the linking of housing benefits to trips to the gym, monitored with smart cards. Most recently there were calls to cut benefits for the obese unless they went on a diet. Suddenly the smart fridge takes on a whole new set of associations.

However, more realistic than nanny-state, nigh-totalitarian social engineering is the probability that we will be negotiated into patterns of "better" behavior by financial imperatives. The fact that insurance, rather than advertising, is being touted as "the native business model" for the internet of things suggests that control may happen through financial penalties. If your smart treadmill doesn't clock a certain number of miles a day, your insurance premium will go up. Furthermore, smoking or enjoying the taste of Bourbon just a little too much may constitute deviant behavior that renders you uninsurable.

The efficiency doctrine—saving energy, saving on healthcare costs—slips very easily into the empty vessel that is the smart home. That is especially true given that it will be introduced through desirable, hyper-performing products. One is reminded of the famous letter that Aldous

Huxley wrote to George Orwell arguing that the "boot-on-the-face" totalitarianism of *1984* was less likely than the dystopia of Huxley's own *Brave New World*: "The lust for power can be just as completely satisfied by suggesting people into loving their servitude as by flogging and kicking them into obedience ... The change will be brought about as a result of a felt need for increased efficiency."[7]

That particular vision situates the home very clearly as the site of a shift from a modernist paradigm to an emergent paradigm of the information age—a shift from efficiency to paranoia, from the machinic to the anthropomorphic. Where Le Corbusier could speak of being "proud of a house as practical as a typewriter," Rem Koolhaas now coolly asserts, "Very soon your house will betray you."[8]

A year before the MoMA exhibition, Superstudio dreamed up the 2000-Ton City. The citizens of this megastructure live in a techno-utopia in which all their desires are fulfilled, unless they entertain any idea of dissent, in which case their ceiling will come down on them with the weight of two thousand tons. As we noted earlier, the smart home is made for black humor and dystopian fantasy.

In fact, the smart home is far from dramatic. Unlike Superstudio's modernism *ad absurdum* or even the very Fifties-ish capsule of Alison and Peter Smithson's House of the Future, the smart home is utterly prosaic in its appearance. It may look no different than your home or mine. When *Time* magazine put "The Smarter Home" on its cover last year ("The dwellings of the future will make you calmer, safer, richer and healthier"), it chose a cheap-looking, suburban cookie-cutter house. (It may well be that the absence of a pitched roof and the addition of a climbing wall were indicators of the height of innovation, but such subtleties are difficult for a European to read.) This was very shrewd of *Time*. Because if the smart home is to become a reality, it will have to adapt itself to the majority of existing homes or be doomed to a tiny market of wealthy eccentrics.

As Dan Hill has pointed out, in a city such as London (which has the oldest housing stock in Europe) the smart home will have to negotiate Victorian walls and Edwardian pipes. In London's overheated property market, money is made hand over fist by simply redecorating, leaving the sins of our ancient infrastructure behind "a kind of nationwide Farrow & Ball sticking plaster."[9] Because getting behind the wallpaper and updating the wiring would be considered "overcapitalizing."

The more metaphorical network, then—the meta-network of the internet of things—is reliant on a literal network of rusty pipes and underground cables. Banham reminds us that Edison's lightbulb would have been useless without his invention of the mains electricity delivery system, reinforcing his point that services (gadgetry and geekery) are what make modernist form possible. But even when

Cover of Time (July 7–14, 2014).

the deployment of electrical services determines the outward form of the building (e.g., Louis Kahn's Richards Memorial Laboratories in Philadelphia), architects go to great lengths to hide them.

We prefer our network infrastructure invisible, and consequently we elaborate nebulous metaphors such as "the cloud." Deep down we know that the cloud is a giant server farm somewhere outside Houston, but out of sight out of mind. Timo Arnall's film *Internet Machine*, shot in a data center in Spain, lingers eerily on the stacks of servers, the whirring fans, and the miles of fiber-optic cable precisely to make such metaphors tangible.

All of which goes to say that the smart home is merely the consumer entry point to a vast new economic territory of invisible infrastructure. The mundane (or even intimate) domestic data of the smart home accumulates into the "big data" of the smart city. And here there are powerful corporate forces at play—forces that our neoliberalized, austerity-riddled municipal authorities may be increasingly powerless to resist. Again the ostensible motive is efficiency: smart waste bins that know when they need to be emptied and smart traffic lights that can recalibrate themselves based on traffic flow. But these services are

politicized through their transfer to the private sector.

When James Bridle quipped recently, "Beneath the paving stones, the cloud," he was pointing to a material reality, just as Arnall was, but the political connotations of that adage are worth dwelling on.[10] Who owns the cloud? Who owns the smart city? Follow the money. The real financial assets of the city will be measured less in ostentatious skyscrapers than in the invisible substrate of cables and sensors. The implications of what Keller Easterling calls "infrastructure space" for architects and architecture are not entirely clear, but what is fairly certain is that the discipline thus far lacks a truly infrastructural perspective. Data as a tool for creating parametric form has an established, if polarized, position, but a genuine network thinking has yet to infect architecture. Architecture is still focused on objects. Or, as Easterling puts it: "Architecture is making the occasional stone in the water. The world is making the water."[11]

X

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2
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3
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Ravi Sundaram

Post-Postcolonial Sensory Infrastructure

More than a decade ago, Rem Koolhaas published his widely circulated essay "Fragments of a Lecture on Lagos" as part of a Documenta 11 platform in that city devoted to African urbanism.[1] Koolhaas went on to consider the status of Lagos, which seemed to have an aura of "apocalyptic violence" and of a "smoldering rubbish dump." A series of further enquiries revealed new informal networks entering the interstices of older, decaying infrastructures. Finally, it was a crucial helicopter ride by which Koolhaas showed that Lagos, rather than bordering permanently on chaos, functioned as a series of functional correspondences, with a dynamic "confrontation of people and infrastructure." This clinching aerial insight followed a familiar trend in the history of architecture. It was through Corbusier's flights in Brazil in 1929 and in colonial Algiers that he formulated his claims for a new form of urban imagination, distinct from ground-level perception. Thus, after one of his Brazilian flights Corbusier wrote ecstatically:

> From the houses, no one sees [Rio]. There is no more land to build upon … There are nearly a dozen bays, closed, isolated. If you walk through the maze of streets, you rapidly lose all sense of the whole. Take a plane and you will see, and you will understand, and you will decide.[2]

American architect Joseph Stein climbs a staircase at the Ford Foundation office in New Delhi, in 1968. Stein designed numerous other buildings in the city, including the India Habitat Center, India International Center, and the headquarters of both Unicef and Worldwide Fund for Nature. Photo: Madan Mahatta/Photoink.

Despite or because of its revelatory encounter lineage, the Koolhaas essay suggested that there was an emerging "instant urbanism" in Lagos beyond the design and

Le Corbusier, Development plan for Rio de Janeiro, 1929. Aerial perspective with the Guanabara Bay, the center and the playas. Charcoal, pencil, and pastel on paper. Copyright: Fondation Le Corbusier, Paris.

designation of postcolonial planning. Its significant limitations notwithstanding, this altogether rare encounter of global architecture with postcolonial urbanism shed light on a dysfunctional-productive space of infrastructure, where constantly moving networks bypassed states and the language of sovereignty.[3] In fact, for some time now, the problematic of circulation has emerged as a new theoretical challenge for debates on infrastructure beyond appearing as a familiar adjunct to neoliberal commodity economies and space-time compression in global capitalism. But first, for a bit of context, let's rewind to the 1950s and the early 1960s.

Talk of Sovereignty

The 1950s saw a tribe of modernist planners and architect-adventurers who ventured to the newly independent countries of Asia and Africa like modernized versions of nineteenth-century European colonial

travellers. Le Corbusier in Chandigarh, Doxiadis in Islamabad, and Buckminster Fuller in Africa and India were all part of this traffic to the Third World. Pushed by local regimes to set up showcase cities, and even by US and Soviet foreign policy coffers, architect-travellers were in fact on the sidelines of a significant urban transformation initiated by lesser-known transnational urban planners and designers who worked to plan and develop actually existing cities with large populations, such as Delhi, Lagos, Beijing.

In 1950s Delhi, for instance, the Ford Foundation sponsored a major exercise by US urbanists to design a city masterplan. Leading the team was Albert Mayer, regionalist architect from New York, who had collaborated closely with Lewis Mumford in the 1940s. Mayer had done the first masterplan for Chandigarh, which formed the basis of Corbusier's larger, better-known interventions. The Delhi Masterplan designed by Mayer and his team incorporated a technocratic grid that would deflect migration flows to the periphery, and protect an urban core that assured sovereignty for postcolonial power. It was the model of the city as an urban machine, with neighborhoods as cellular units, linked by a technocratic hierarchy of functions and power. This was a model city with a centralized command regime, with designated legal subjects. The design was a dramatic performance of postcolonial sovereignty for the new regime. The nationalist city would oversee the proper circulation of people and things through careful zoning and state control of all land. This would purge the circulatory corruptions of the Moghul city, with its mixing of bazaar and residence, human and animal, all of which was seen by the US planners through the pathologies of 1950s modernization theory and Cold War liberalism. Infrastructure itself would designate the form of the city, and resolve what was seen as the ultimate postcolonial shame: poverty and the urban slum.

In a way, this model became a liberal design narcotic for the postcolony of the 1960s. The Ford Foundation sponsored the largest urban project in the world in Calcutta, funding international planners, architects, and sociologist consultants. Western design and engineering firms successfully pitched urban modernization projects in Latin America, Africa, and Asia.

The last few decades have seen the unraveling of this model of urban planning, a tiringly familiar story that played itself out in Asia, Africa, and partly in Latin America. In Delhi, for example, the very forms that the technocratic machine sought to control—economic proliferation, urban sprawl, pirate markets, and migration—all imploded and rendered the control model inoperable. The exact infrastructures that were the hallmark of a new modernity—electricity, roads, water pipes—became locations for new conflicts and claim-making by subaltern populations. The already tottering planning machine splintered, and the technocratic hierarchies of the plan

became meaningless. As urban regimes lost the ability to sustain the definitional aspects of the city, infrastructures became the site of new experiments. Pirate cities saw populations poach existing sites: overpasses, unused urban land, abandoned spaces. Remarkably, almost to the letter the post-planning mise en scène resembled Deleuze's fragmentary notes on "control society." Deleuze had suggested that modulation, rather than old-style discipline, transforms the rhythm of movement, blurring entry and departure points. Control society was "like a self-deforming cast that will continuously change from one moment to the other, or like a sieve whose mesh will transmute from point to point."[4]

Mobile Phone Charging Station, Uganda, 2011. Photo: Adam Cohn.

Remarkably, just a few years before this time, Jean Baudrillard's 1977 text "The Beaubourg-Effect" had confidently announced the obituary of radical movements of urban circulation.[5] Ostensibly a critique of the Renzo Piano/Richard Rogers Pompidou Centre complex in the Beaubourg area of Paris, Baudrillard's essay connected information, transparency, the circulation of people and fluids, and the death of the social project associated with 1968. For Baudrillard, the Beaubourg "thing" was a "carcass of flux and signs, or networks and circuits," its "cool" exposed tubes on the building suggesting not transparency, but a strategy of anxious spatial "deterrence." Along with its over-informationalized exterior, the building's model of endless internal circular movement was an image of controlled socialization. At the heart of the rhetorical populist gesture incorporating the mass was a shift:

> Because this architecture, with its networks of tubes and the look it has of being an expo or world's fair building, with its (calculated?) fragility deterring any traditional mentality or monumentality, overtly proclaims that our time will never again be that of duration, that our only temporality is that of the

accelerated cycle and of recycling, that of the circuit and of the transit of fluids.[6]

What emerges in the tense encounter between the design and the flow is a critical mass "no longer tied to specific exchanges or to determinate needs but to a kind of total universe of signals; through this integrated circuit impulses travel everywhere in a ceaseless transit of selections, readings, references, marks, decodings."[7] Notice how in Baudrillard's post-Marxist moment, *the signal* has replaced abstract labor/money, dis-embedding the "mass" in the process of circulation. Frankly, Baudrillard's prescient synthesis of McLuhan and Adorno did not do much for me when I first read it some years ago; but today we can better grasp his points about the disjunction between the different orders of circulation: the cool surface and the uncontrolled, unknowable "mass" it sought to incorporate. If the Beaubourg design proclaimed the end of the old social model of revolutionary politics, the only hope was a post-universal, "ungraspable" and "non-extendable" model of circulation.[8]

CAMP (Shaina Anand & Ashok Sukumaran), From Gulf to Gulf to Gulf, 2013. Video, 83 min.

What if a different constellation emerged from this transaction of populations and information in "ceaseless transit," one that forced us to ask questions about the political itself? This question has come to the fore in postcolonial cities, and I suspect in every other urban form across the globe.

A Sensory Infrastructure?

Postcolonial urban governance operated within a code that functionally separated the social and the medial. The domain of the social was demarcated by welfare and the governmental nurturing of a healthy population. The medial occupied the realm of leisure: to be serviced by infrastructural sites like newspapers, film studios, television networks, cinema theaters, radio stations. Welfare was the domain of the state and politics, and the institutions of the medial were managed by regulators and censors. Governmental power periodically filtered and differentiated two orders of circulation: of people and things, and of public affect—where populations were kept away from the dangers of "sensuous provocation." Once the movement of people and things began overlapping with circulating media, this postcolonial design stood compromised, putting the "social" into question. Via a Kittlerian lens, we could say that if media "determines" our urban situation by becoming its infrastructural mesh, it simultaneously undermines and implodes the representational models of postcolonial power.[9]

By the late 1980s, infrastructures became the center of media circulation by way of entangling people, objects, knowledges, and technologies. Following the cassette boom in the 1980s, media infrastructures expanded rapidly in the postcolonial world, in the context of a large urban informal economy. Media formats and platforms have proliferated along with an endless profusion of personalized media gadgets that range from expensive smartphones to low-cost models used by the poor. The transformation of postcolonial life into a dynamic technological culture is wide ranging, affecting all sections of the population. The majority of India's citizens now have cellular phones, through which they have access to audio, video, and still images. With the cellular phone, a growing section of the postcolonial population is now the source of new-media output—which in turn links to online social networks, mainstream television, and peer-to-peer exchanges of text, music, and video.

These expanding media infrastructures have formed a dynamic loop between fragile postcolonial sovereignties and informal economies of circulation.[10] Indifferent to property regimes that come with upscale technological culture, subaltern populations mobilize low-cost and mobile technologies to create horizontal networks that bypass state and corporate power. Simultaneously, we witness the expansion of informal networks of commodification and spatial transformation. This loop shapes much of contemporary media circulation, where medial objects move in and out of infrastructures and attach themselves to new platforms of political-aesthetic action, while also being drawn to or departing from the spectacular time of media events.[11]

As state authority weakens either through economic crisis, neoliberal reforms, or war, infrastructures also perform a kind of "doubling" role. Two decades ago, an

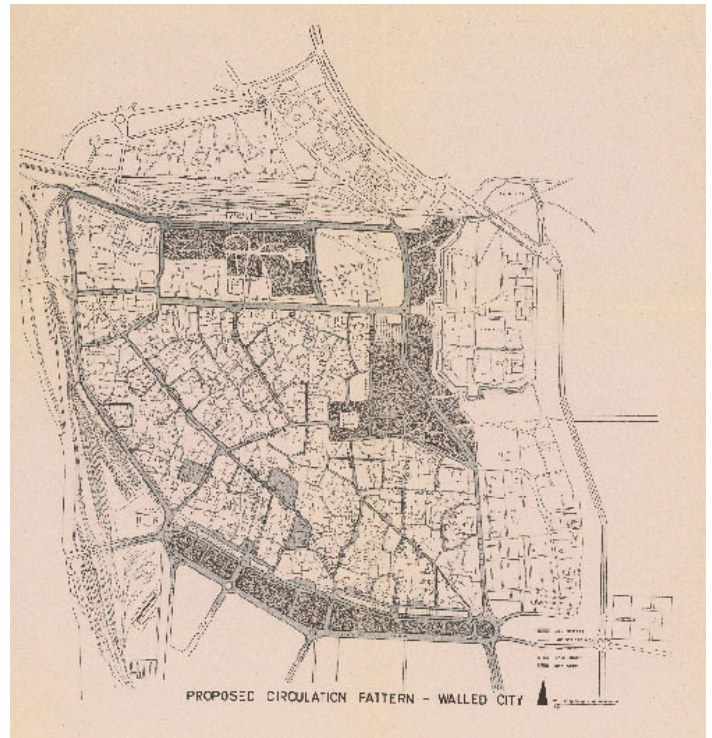essay by Achille Mbembe and Janet Roitman intimated this churning:

> Fraudulent identity cards; fake policemen dressed in official uniform; ... forged enrollment for exams; illegal withdrawal of money orders; fake banknotes; the circulation and sale of falsified school reports, medical certificates and damaged commodities ... It is also a manifestation of the fact that, here, things no longer exist without their parallel. Every law enacted is submerged by an ensemble of techniques of avoidance, circumvention and envelopment which in the end, neutralize and invert the legislation. There is hardly a reality here without its double.[12]

This doubling of infrastructures may also produce a poetics, with new aesthetic and political possibilities. This is powerfully expressed in the Bombay artist collective CAMP's recent video project *From Gulf to Gulf to Gulf*.[13] The project tracks the movements of commodities, local ships, and sailors across the contemporary turbulent geographies of the Indian Ocean: Somalia, Aden, Sharjah, Iran, Pakistan, and Western India. In *Gulf to Gulf to Gulf*, sailors' cell phone videos generate connections between sailing routes, the death and life of ships, and work time and dream time. The film portrays the edge zones of the sea, moving beyond the familiar tropes of maritime piracy, terrorism, and war. By using the infrastructural turn for a conversation on space, aesthetics, and politics, *Gulf to Gulf to Gulf* moves easily between the circulations of people, media, and commodities.

Circulation Plan for the Old City of Delhi, Ford Foundation Team—Delhi (1960). Image: Delhi State Archives.

Circulation Takes Command

William Mazzarella suggests that postcolonial censorship's "performative dispensation" was to play both police and patron, in a chronic state of cultural emergency that is the condition of mass publicity. This was a foundational transaction between the unstable "open edge" of mass publicity, and the assertion of sovereign power, whose authority was periodically evoked to filter authorized and unauthorized sensuous transgressions.[14]

The management of public affect through authorized circulation has broken down all over the postcolonial world, if not elsewhere, disrupting older transactions between sovereign power and a population seen as susceptible to sensorial powers. Media has become the infrastructural condition of *living*, rather than existing as distinct, regulated sites like the cinema theater, or as celluloid. The always emergent potential (or "becoming virtual") of mediation is now a generalized condition of affect-driven postcolonial media modernity in India, if not most parts of the world today.[15] The older police function

of postcolonial governance was to privilege select circuits of media exhibition and consumption. Today, new forms of unauthorized publicity have actively destabilized this regime and fed into new loops of circulation. Blurring and confusing the distinctions between the legal-nonlegal, private-public, fact-artifact, and governmental-nongovernmental, the new interventions span homes, governmental offices, political parties, individuals, industrialists, and just about all walks of life.

This has been accompanied by thousands of everyday acts from a media-enabled population. A volatile, sensory infrastructure emerged, combining pirate tactics, media forms, and paralegal space. New, unregulated forms of media (audio, video, images) began to rapidly circulate from urban populations hitherto seen solely as social-political actors. These interventions operated alongside an expanded and often chaotic governmental surveillance regime, as well as a visceral media archive that emerged from the private collections of accident witnesses, estranged lovers, paramilitary torturers, and ordinary citizens with camera-equipped phones. From the initial affect-charged moment of publicity, this media archive joins the global traffic in poor images, moving away and attaching to new environments.

This ever-expanding circulation engine has significantly challenged the premises of postcolonial urban design, which at its origin was indexed to stable arrangements of people and things. The category of the population, seen as

An eclipse seen through the light passing through tree leaves. The effect, similar to a pinhole camera, is portrayed here in this images taken in Atlanta, May 30, 1984. Photo: Rod Nave.

solely an object of nurture and welfare, is now increasingly unsustainable. What do you do when social-political actors are also media proliferators? There is a conceptual (and productive) blur between affect-driven infrastructures and the movement of media. Ficto-graphic atrocity stories (images, sounds, videos) circulate and attach themselves to sites of violence; in India, for instance, "fake" videos have been held out as reasons for disturbances in various cities and for the intimidation and killing of minority populations.

Crowds or Shadows?

The circulation engine creates a surplus of shadow networks. In older modes of governance in India, paper-based databases (electoral rolls, ration cards) produced by state functionaries intersected with political mobilizations at local and city levels. Colonial power was based on a powerful deployment of paper-based information systems for routine policing as well as the management of migrants, epidemics, and cross-border movements. After independence, the postcolonial regime drew significantly from this system, by aligning it to republican democratic politics. As typical postcolonial technologies of visibility, paper-based information systems allowed the regime to manage urban residents through systems of inclusion and exclusion, while for political groups, entry into the database constituted an important vector of everyday life. Such political strategies could range from selective, strategic entry into some databases (electoral rolls, ration cards) with fuzzy land-ownership patterns and informal systems of electricity and water.[16] In short, entry into one information system could coexist with tactical invisibility in another. Small traders and migrant residents of squatter settlements moved in this shifting information ecology.

In the contemporary digital era, this is a neurophysiological zone amplified by the mix of mobile computing objects, moods, and sensations. Provisional networks form around these temporary connections: Bluetooth sharing of media by sailors, urban proletarians, and migrants; shadow libraries moving via USB drives; hawala transfers via text; neighborhood shops that refill phone memory cards with pirate media. Online shadows exist in WhatsApp sharing networks, dancing around regimes and mobile company filters. This is a remarkable infrastructure of agility and possibility.[17] Will this become a logical object of a new post-Tardean political economy of propensity?[18] This means not just emerging corporate-funded research on proprioception, facial recognition, and gesture, or all the contemporary Big Data rhetoric and the excitement about the algorithmic turn. Emerging players like Alibaba in China and Snapdeal in India dream of tapping the energies of the new urban information ecology, while regimes push for connecting cellular phones to identification. But perhaps not. The dream of stable designation was the ruination of postcolonial design in its powerful heyday, and the current dream of platform capitalism may be no different.[19]

An architecture of shadows anyone?

X

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1
Rem Koolhaas, "Fragments of a Lecture on Lagos," in *Under Siege: Four African Cities—Freetown, Johannesburg, Kinshasa, Lagos (Documenta11_Platform4)* , ed. Okwui Enwezor, Carlos Basualdo, Ute Meta Bauer, Susanne Ghez, Sarat Maharaj, Mark Nash, and Octavio Zaya (Ostfildern-Ruit, 2002).

2
Cited in Adnan Morshed, "The Cultural Politics of Aerial Vision: Le Corbusier in Brazil (1929)," *Journal of Architectural Education* , vol. 55, no. 4 (2002): 201–10; 205.

3
This encounter was thoroughly criticized by various writers for obfuscating the ground realities of Lagos. For a critical response see Matthew Gandy, "Learning from Lagos," *New Left Review* 33, (May–June 2005).

4
Gilles Deleuze, "Postscript on the Societies of Control," *October* 59 (Winter 1992): 3–7; 4.

5
Jean Baudrillard "The Beaubourg-Effect: Implosion and Deterrence," trans. Rosalind Krauss and Annette Michelson, *October* 20 (Spring 1982): 3–13; 5.

6
Ibid., 5.

7
Ibid.

8
Pointing to Italian "radio pirates" at the end of the essay, Baudrillard suggested that their real danger to the "system" lay not in their politics but in their "non-extensible" and "dangerous" localization.

9
Friedrich Kittler, *Gramophone, Film, Typewriter* (Stanford: Stanford University Press, 1999). Kittler began his classic text with this sentence: "Media determine our situation, which—in spite of, or because of it—deserves an explanation." xxxix.

10
See Brian Larkin, *Signal and Noise: Media, Infrastructure, and Urban Culture in Nigeria* (Durham: Duke University Press, 2008).

11
See *Sensible Politics: The Visual Culture of Nongovernmental Activism* , ed. Meg MacLagan and Yates McKee (New York: Zone Books, 2012).

12
Achille Mbembe and Janet Roitman, "Figures of the Subject in Times of Crisis," *Public Culture* 7, (1995): 323–52; 340.

13
See *Gulf to Gulf to Gulf* in the Indi ancine.ma archive https://indianc ine.ma/BBRJ/info

14
William Mazzarella, *Censorium: Cinema and the Open Edge of Mass Publicity* (Durham: Duke University Press, 2013).

15
Lauren Berlant, *Cruel Optimism* (Durham: Duke University Press, 2011).

16
Informal tenure rather than formal, title defines urban residence in most postcolonial cities.

17
It is also a visceral vehicle of terror where political productivity can articulate intimidation, exploitation, and aesthetics.

18
See Nigel Thrift, "Pass it on: Towards a political economy of propensity," *Emotion, Space and Society* 1 (December 2008): 83–96.

19
See Geert Lovink, Sebastian Olma, and Ned Rossiter, "On the Creative Question – Nine Theses", Institute for Network Cultures http://networkcultures.o rg/mycreativity/wp-content/uplo ads/sites/20/2014/11/MyCreativ ity_manifest2.pdf

Eyal Weizman

Violence at the Threshold of Detectability

The new millennium began with a bizarre legal battle. The David Irving trial, which unfolded at the English High Court of Justice between January and April 2000, involved one of the most aggressive cross-examinations of architectural evidence—drawings, models, aerial and ground-level photographs—ever undertaken in a legal context. The case unfolded around a libel suit filed by David Irving against an American writer and her publisher, Penguin Books, for calling him "the most dangerous of all holocaust deniers and a falsifier of history."[1] Awkwardly, the process forced the veracity of claims on both sides to be put on trial, and crucially not by means of historical narration, but by subjecting the accusations to legal rules of evidence. On the tenth and eleventh days of the trial, January 26 and 27, the legal debate revolved around the architecture of one of the gas chambers—an underground structure that was part of Crematorium II in Auschwitz-Birkenau. One detail emerged as central to this debate. Irving, representing himself, focused his cross-examination of the expert witness facing him—architectural historian and Auschwitz expert Robert Jan van Pelt—on four small holes in the ceiling of the concrete roof of the structure.[2] According to the few surviving witnesses—both victims and perpetrators—it was through these holes that the cyanide poison coming out of canisters labeled "Zyklon-B" would enter a room packed with thousands of people.

Van Pelt's expert report, submitted to the court before the session began, conceded that "these four small holes ... cannot be observed in the ruined remains of the concrete slab," but explained that verification was impossible due to the state of the roof. The roof slab broke, twisted, and folded in on itself in the explosion that was meant to eliminate its use as evidence, and has only disintegrated in the fifty-six years since. Traces of the holes were discovered a few years later,[3] but in 2000, the court heard the following exchange:

> **Irving**: And you do accept, do you not, that if you were to go to Auschwitz the day after tomorrow with a trowel and clean away the gravel and find a reinforced concrete hole where we anticipate it would be from your drawings, this would make an open and shut case and I would happily abandon my action immediately?
> **Van Pelt**: I cannot comment on this. I am an expert on Auschwitz and not on the way you want to run your case.
> **Irving**: There is my offer. I would say that that would drive such a hole through my case that I would have no possible chance of defending it any further.[4]

Irving's line of argument proposed that without these

Robert Jan van Pelt points to the ruins of Crematorium II in Auschwitz-Birkenau. The gas chamber is on top and the arrows indicate the probable location of the holes in the ceiling.

Fredrick Töben, an Australian holocaust denier, fits himself through a break in the roof of Crematorium II at Auschwitz-Birkenau. He is trying to demonstrate that a particular opening was too large to have been one the lethal holes.

holes, the cyanide poison could not have been introduced into the room, and the room thus could not have functioned as a gas chamber. If the structure was not a gas chamber, then indeed Auschwitz could not have been a death camp. Without Auschwitz as the functional and symbolic center of the extermination process, the Holocaust, as a premeditated policy of industrialized racially motivated killing, could never have happened. "No holes no holocaust," as another negationist already proposed[5]; and if it didn't happen, Irving could not be accused to be the falsifier of history— *quod erat demonstrandum*!

The use of material evidence to contradict survivors' testimony had already been an established method used by Holocaust deniers. Witness testimony, they claimed, produced "too much metaphysics, not enough materialism."[6] However, it was not simple positivism that led deniers to insist on materiality, but rather a desire to

preclude the very ability of witnesses to speak to history at all. By posing matter against memory, they demanded a history without subject and beyond language. In Irving's legal strategy, the fact that the holes could not be found became "negative evidence" against the process of extermination. Negative evidence is an oxymoronic term that legal scholars use in order to refer to an absence of material evidence that they want to be considered as evidence in itself.[7] It is what defense teams mobilize to disrupt prosecution cases: no body, no gun, no holes. In legal terms, it is a kind of antibody that comes to disrupt and dismantle complex epistemological assemblages of networked evidence. Furthermore, given that a hole is not matter, but a gap within material continuity, the issue at stake was not a simple absence but a certain "absence of an absence." Throughout the trial, Irving also seemed obsessed by the metaphorical power of holes: "I am going to keep on driving holes in this case until your Lordship appreciates the significance of the holes, or their absence."[8]

Harun Farocki's 1988 film *Images of the World and the Inscription of War* presented an inadvertent prequel to this story. On August 25, 1944, a US reconnaissance mission was sent to photograph a petrochemical factory—Monowitz-Buna—next to the Auschwitz-Birkenau extermination camp. The five-by-three miles of territory captured in a single 35mm negative included the roof of Crematorium II, somewhere close to the edge of the frame in the lens' area of parallax distortion. The discovery that this image, along with a few other aerial photographs from the spring and summer of 1944, contained photos of the crematorium took place only in 1978, when they were found by two CIA image analysts named Dino Brugioni and Robert Poirer. When enlarged, Brugioni and Poirer spotted four blurry marks on the roof of the crematorium building and annotated them as "vents."[9]
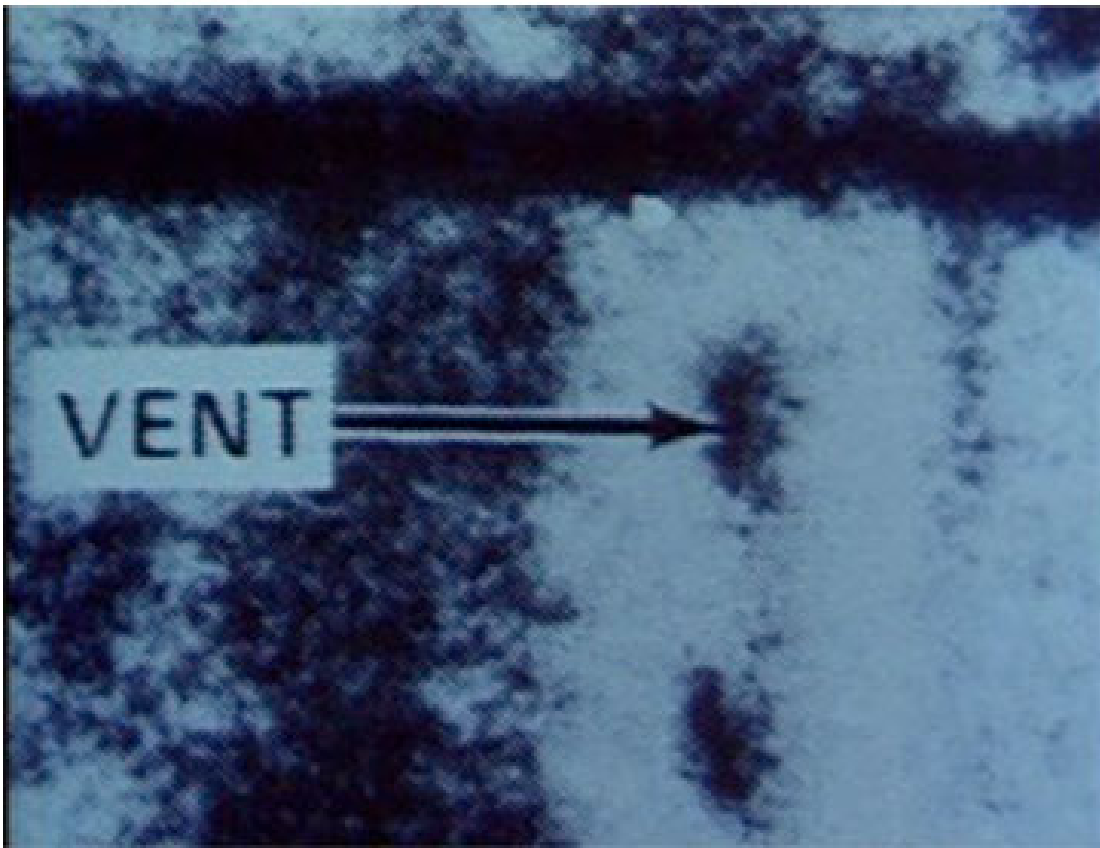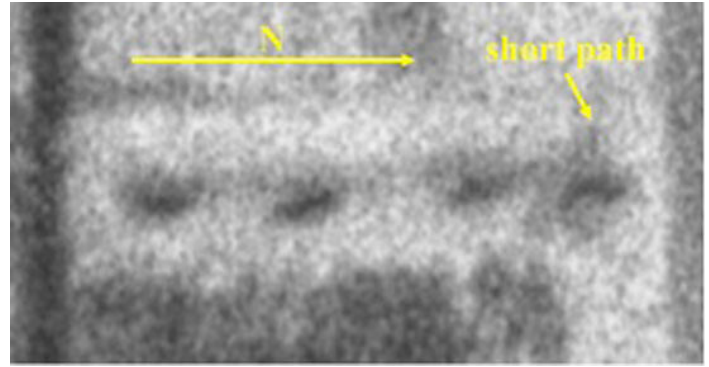
Harun Farocki, Images of the World and the Inscription of War, 1988. The pattern interruption on the image of the vents is a result of printing. The image was filmed from a print. For the photographic interference pattern please see the following images.
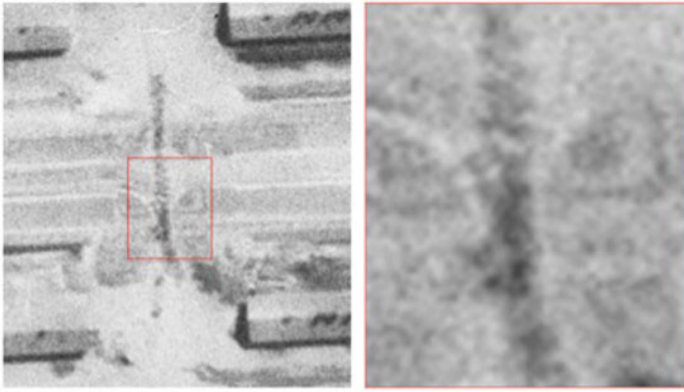
A group of prisoners is marched through Auschwitz. US Air Force, August 25, 1944. The size of the head of a single prisoner on the ground is the size of s single silver salt particle in the film. Courtesy of Nevin Bryant (NASA).

The roof of Crematorium II (Rotated 90 degrees clockwise in relation to the first image above), Auschwitz Birkenau, US Air Force, August 25, 1944. Nevin Bryant explained that the four dark areas are the Zyklon holes. He identified the short interference path next to the hole farthest to the right as a person, possibly an SS personnel, on the roof. Image courtesy of Nevin Bryant/NASA.

Irving claimed that the four marks could not be the four holes in the roof. They had a strange interference pattern, he said, and suggested that the negative had been tampered with by the addition of "brush strokes."[10] Already familiar with such arguments from negationist literature, Van Pelt presented a report prepared by Nevin Bryant, supervisor of image processing applications at NASA's Jet Propulsion Laboratory in Pasadena and an expert in the analysis of aerial and satellite images. While the CIA analysts were enlarging the negatives with the analogue optics available at the end of the 1970s, Bryant used state-of-the-art digital magnification to peer into the "molecular composition of the film." At stake was the way in which concrete elements got recorded by the silver halide crystals, the very chemical composition of a film, with about fifteen thousand feet of atmosphere in between. From this altitude and at the resolution of the specific negative used by the US Air Force, a single grain represented an area about of about half a meter squared on the ground.

Bryant suggested that the interference pattern, identified by Irving and other negationists, is a phenomena that can occur on the level of the grains in the emulsion of the film when single objects on the ground are at, or close to, the size of a single silver salt particle in the film.[11] He first noticed a similar process in a small section of another photograph that was on the same roll of negatives (a reconnaissance plane shoots a fast automatic sequence of photographs along its flight path). This section of the image captured a group of prisoners being marched within the camp. Irving similarly referred to this representation of prisoners as "brush strokes." Responding to the judge's request for clarification, Van Pelt repeated Bryant's conclusion: the interference pattern is caused when "the size of a head of a person is the same as the size of a grain in the the emulsion of the film, and the result of that was that a *moiré effect,* which occurs also in the newspaper when you photograph a picture

which has been screened twice."[12]

The size of the hole in the roof of Crematorium II was approximately the size of a person as seen from above. The hole was thus approximately the size of a silver salt grain. When an object photographed approximates the recording ability of a negative, it is in a condition that we can refer to as the *threshold of detectability*. In this condition, the materiality of the object represented (the concrete roof/hole) and the materiality of the surface representing it (the surface of the negative/silver salt grains) should be considered both as *presence* and as *representation*. Each surface must be equally analyzed as an image and as a material reality.

A certain inversion also occurred: the concrete roof was analyzed as a recording device, while the molecular surface of the negative was seen as a material composition of silver crystals.[13] The photograph of the roof was thus a photograph of a photograph.

As the cross-examination went on, it became clear that against the linear argument mobilized by Irving's negative evidence, Van Pelt had woven a complex and overwhelmingly convincing network of converging evidence, both for the existence of the holes on the surface of the negative as well as for its existence within the broken concrete surface.[14]

Irving lost the case, and my aim is not to reopen it. What we should take from this story, as we move on, is the problems of violence at the threshold of detectability.

*Drone Warfare at the Threshold of Detectability*

Above: Kent Klich, Tuffah, Northern Gaza, 2009. Below: A much smaller hole was recorded by Chris Cobb Smith, Gaza, 2009. Here the hole is made by a hollow charge—a stream of melted steel. Analysis by Forensic Architecture.

I recalled the Van Pelt–Irving exchange about the holes when asked to undertake, through Forensic Architecture—a forensic agency of architects, artists, and filmmakers[15]—an investigation on drone warfare in Pakistan, Afghanistan, Yemen, Somalia, and Gaza.[16] This was because many of the buildings struck by drones had a specific architectural signature to them—a small hole in their ceiling. The reason for this hole was that drone missiles, such as Hellfire or Spike, are equipped with a delay fuse. The few milliseconds between impact and detonation allow the missiles to penetrate through a roof into the room under it and spray their load of hundreds of lethal steel fragments inside. This blast of small fragments, designed to kill people but to leave the structure intact, is argued by the military to be a humanitarian munitions meant to limit casualties. Like many other techniques and technologies of "lesser evil," this one enabled the proliferation of such strikes, thus causing more casualties.[17] Seen from above, the hole in the roof is the only visible trace that the building was attacked by drones. But this hole, and the violence it evidences, are also at the threshold of detectability. This is because the size of the hole that a missile makes in a roof is smaller than that of a single pixel in the resolution to which publicly available satellite images are degraded.

Until 2014, this resolution was legally kept to 50 cm/pixel, with a pixel representing half a meter by half a meter of ground.[18] This resolution was legally determined because it is roughly the size of the human body when seen from above. The pixel resolution is not only a technical product of optics and data-storage capacity, but a "modulor" designed according to the dimensions of the human body. Unlike other architectural modulors (most notably that of Le Corbusier), it was not meant to help organize space, but rather to stamp the human figure out of photographs. The 50 cm resolution is useful because it bypasses risks of privacy infringement when recording people in public spaces, much in the same way that Google Street View blurs the face of people or car license plates. But the

regulation also has a security rationale: it is not only important details of strategic sites that get camouflaged in the 50 cm/pixel resolution, but the consequences of violence and violations as well.[19] The resolution of satellite images have direct bearing on drone attacks. Although at a resolution of 50 cm the general features of individual buildings can be identified, a hole in a roof—the signature of a drone strike—would appear as nothing more than a slight color variation, a single darker pixel, perhaps, within a pixel composition.

The 50 cm/pixel satellite imagery thus poses a digital version of the material problem presented by the silver salt particles in the negatives of the Auschwitz aerial photographs presented in the Irving trial. It masks a hole in a roof—a hole that is similarly related in its dimensions to the human body. In both, the hole in the roof is an indication that the room under it was an assassination chamber. In both, this hole was at the threshold of detectability in the images in which it was captured. My claim is of course not that there is a relation between the Holocaust as an attempt to exterminate an entire people in gas chambers, and a secret and illegal war conducted by the US in densely populated civilian areas, but rather that the forensic-architectural problem that arises forces us to examine the material limit of images.

We do not know the precise optical specifications of drone cameras. Some operators stated publicly (or told us privately) that they could identify people. They claimed that sometimes they could even recognize them. Others said that the resolution was not sharp enough to differentiate children from adults and that they have mistaken spades for guns.[20] All statements confirmed however that the human figure is the thing to which drone vision is calibrated, obviously because it is designed to
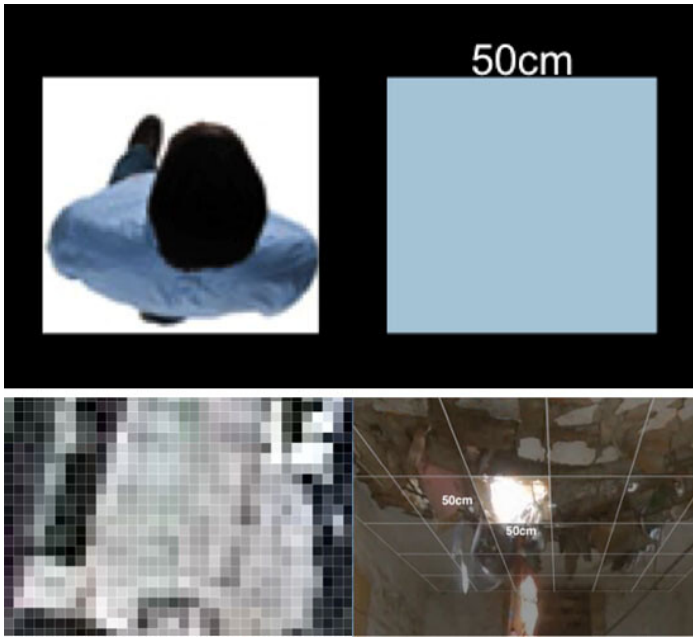
Right: A large hole in the roof of a shop in a market in Miranshah, Pakistan is left after a strike on March 30, 2012. Left: A satellite image depicts the same roof less than a day after the strike. We know this hole is in one of the pixels but cannot tell exactly which—likely one of the darker ones. Forensic Architecture, 2013.

deliver munitions to people and kill them. However, while the human figure is the convergent point of drone vision, it is what satellite images are designed to mask.

The UN, via UNOSAT—its program delivering satellite-image analysis to relief organizations—as well as other research bodies, increasingly monitors violence by purchasing images from the archives of commercially available satellite companies. The analysis is undertaken by studying "before and after" images which are the most common form of forensic montage designed to frame an event between two spatiotemporal conditions: the "before" setting the benchmark against which the "after" state displays the result of an incident. Because satellite images render people invisible, the focus of the analysis turns to architecture, to the pairing or sequencing of buildings with ruins.

Both the act of military killing and the practice of investigating those killings are image-based practices, afforded through the combination of proximity and remoteness that is the condition of media itself. Drone strikes themselves are performed in a high-resolution designed to show information, but are monitored (by NGOs or the UN) in the poor resolution of satellite photographs designed to hide information. This fact inverts one of the foundational principles of forensics since the nineteenth century, namely, that to resolve a crime the police should be able to see more—in higher resolution, using better optics—than the perpetrator of the crime is able to. This inversion is nested in another, because in the case of drone strikes it is state agencies that are the perpetrators. The difference in vision between remote perpetrator and remote witness is the space of denial—but of a different kind than the denial presented earlier in this essay.

The formulation for denial employed by US agencies is officially sanctioned as the "Glomar response," stating that US state agencies are authorized to "neither confirm nor deny" the existence—or nonexistence—of documents and policies such as a secret war of assassination in Pakistan. To say "this is untrue," or "this did not happen," is an antithesis that requires a counter narrative. Glomarization is however a form of denial that aims to add no information whatsoever. This form of denial has its corollary in the visual field through the satellite image's inability to neither confirm nor deny the existence or nonexistence of holes in roofs that would otherwise constitute evidence of state-sanctioned violence. This form of denial is not simply rhetorical, but rather is made possible by the production of a frontier that has territorial, juridical, and visual characteristics.

Take for example the Waziristan region of Pakistan, since June 2004 one of the focal points for the drone campaign. Waziristan is part of the Federally Administered Tribal Areas (FATA). During the period of the British Raj, FATA was established as an extraterritorial zone of local autonomy. The Pakistani military established checkpoints that filter movement in and out; it also prevented the bringing-in and taking-out any electronic equipment, including mobile phones, cameras, and navigation equipment.[21] The consequence is an effective media siege in which very few photographs and eyewitness testimonies were allowed to leave these regions. This media blackout enabled the drone warfare in these areas. It also helped Pakistani and US sources to deny this campaign ever existed and helped them to misleadingly claim that the casualties of drone strikes died rather in "bomb-making accidents."[22] In masking all signals within it, the pixel is the human-scale equivalent of the territorial-scale media blockage extended over FATA.

Return to the Witness

Facing the limitations of remote witnessing, one might turn to the testimony of survivors. I would like to present two investigations concerned with witness testimony of a different nature: the first is a video testimony shot hastily by a witness feeling him/herself to be in danger, and the second is based on the slow recollection process of a survivor of a drone strike.

The first investigation was concerned with a close study of a video testimony shot using a handheld camera (most likely a mobile phone) in the aftermath of a March 30, 2012
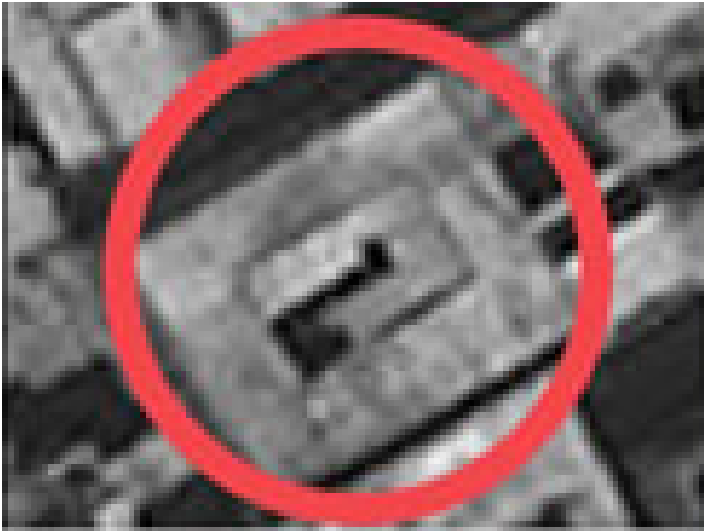
One day before and one day after an April 29, 2012 drone strike on a former girls' school in Miranshah, North Wasiristan, Pakistan. This is a regular method of UN investigations, but it reveals no difference. Forensic Architecture, 2013.

Chris Cobb Smith, Gaza, 2009. Analysis by Forensic Architecture. The boy sleeping at the time the missile hit was saved in this case.
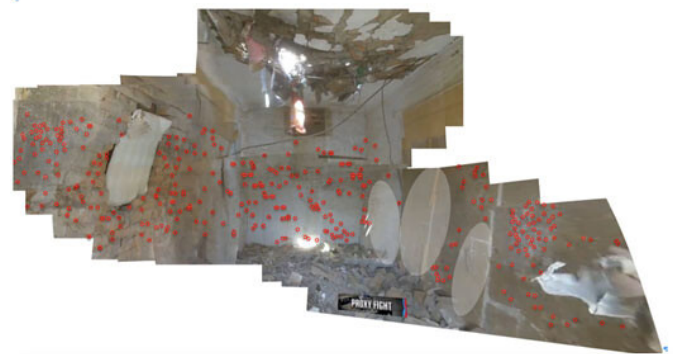
Above: The aftermath of a drone strike on March 30, 2012. MSNBC, The Rachel Maddow Show, June 29, 2012. Below: A photo-collage of dozens of still frames compose an image of a room where people died. The gaps in the pattern may represent the bodies.

drone strike in Miranshah, North Waziristan, in which four people were reportedly killed. It was a rare piece of

evidence, one of very few videos documenting a site destroyed by a drone strike.[23] The video had to be physically smuggled out of Waziristan, passed from hand

Forensic Architecture, 2013. See →

to hand throughout several weeks, before arriving in the NBC offices in Islamabad, which broadcasted twenty-two seconds from this footage. It was one of the first recorded representations of a building being hit.

The video had two main sequences. Each of the sequences involved a different room. The first showed the damaged building from the window of a room in higher building next to it. The second was an interior sequence showing the room targeted. The first room revealed something about the videographer, and the second room revealed something about the people killed in the blast.

The first sequence in the video has a large proportion of the window frame within the image frame. The window frame is not dead information; it rather makes one realize that the videographer was recording from within a certain depth inside the room, careful not to cross the window line. Every photograph records, of course, both the thing being photographed, as well as the state of the photographer.[24] The concrete window frame in the image frame likely captures the videographer's sense of danger. The videographer might be worried about being considered a spy, or about being seen by US drones still hovering overhead, or both.

The second room captured in the video clip was the one in which the people were killed. There was a hole at the center of the ceiling through which the missile had

entered. The wall is seen pockmarked with hundreds of small traces from the explosion. These are the lethal fragments in the munitions head designed to kill people. Carefully studying every video frame that captured the surface of the wall, I have noticed two distinctly shaped areas in which there are no fragments. The bodies of people in the room absorbed these fragments, leaving a peculiar "shadow" on the wall. The wall itself functioned as a photographic film. The people were exposed to the blast in a similar way in which a photographic negative is exposed to light.[25] The wall as a media form connected architecture and the dead body, pathology and forensic architecture.

The Architecture of Memory

The second case is based on aural testimony of a drone strike survivor. The witness is a German woman who was at her home in Mir Ali, North Waziristan, when it was hit by a drone-fired missile on October 4, 2010. She prefers to remain anonymous. The strike killed five people. After the attack, the witness returned to Germany, where she delivered her testimony to her lawyers and in the media. However, some of the details of the attack were obscured in her memory, which was interrupted by the experience of extreme violence. Many of the witnesses we work with deliver testimonies about the worst moments of their lives, days in which they lost loved ones.

Sitting between her lawyer and an architect acting as a computer modeler, she directed the process in which a detailed model of her house was constructed. The model included all rooms, furniture, and objects the witness could remember. Slowly, as she was sizing the rooms, locating the windows and doors, and placing mundane objects in these spaces, she started recalling and narrating fragments of memory from her life in this house and also from the strike itself. When the digital model was complete, we rendered it and undertook a series of virtual walk-throughs. "Returning" to the space and time of the strike, the witness could recount her story.[26]

One object in particular was important to the witness. It was a fan. She seemed uneasy about it, repeatedly adjusting its location. At the beginning it had been modeled as a ceiling-mounted ventilator; then the witness placed it as a free-standing fan on a tripod inside a room. A few moments later she took it outside and placed it in a small courtyard that mostly served the women and children. The house was gender-segregated; most of its space was reserved for men, and women were confined to a small part within. This limited the witness optics of the events that unfolded. When "walking" through the model in the digital aftermath of the strike, she recalled finding human flesh on the fan's blades.[27] The fan was a digital object but also a vehicle into her memory. Human memory, architecture, destruction, and digital reconstruction got entangled here in a way that does not surrender to the easy separation of subject and object, testimony and evidence, matter and memory.

Both these investigations were based on different acts of bearing witness. They however had another important element in common: they both involved risk-taking. In order to be made public, both the witness and the video had to make an indeterminate path out of a frontier zone under military siege.[28] As testimonies that involve risk and the courage to confront sovereign violence and its denial, these acts posed the most fundamental ethical and conceptual challenge to the aesthetic-political practice of forensic architecture.

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An earlier version of this essay was published as an introduction to (Sternberg Press, 2014) and was the basis for a film that Harun Farocki planned to make using other elements from *Forensis* shortly before his death. This essay is thus dedicated to his memory.

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1
Deborah E. Lipstadt, *Denying the Holocaust: The Growing Assault on Truth and Memory* (New York: Free Press, 1993).

2
An extended version of Van Pelt's expert report was republished as: Robert Jan van Pelt, *The Case for Auschwitz: Evidence from the Irving Trial* (Bloomington: Indiana University Press, 2002). Van Pelt's work is one of the main inspirations for Forensic Architecture.

3
Van Pelt, *The Case*, 2–3. The holes were since found; see Daniel Keren, Jamie McCarthy, and Harry W. Mazal, "The Ruins of the Gas Chambers: A Forensic Investigation of Crematoriums at Auschwitz I and Auschwitz-Birkenau" https://watermark.silverchair.com/hgs_18_1_68.pdf?token=AQECAHi208BE49Ooan9kkhW_Ercy7Dm3ZL_9Cf3qfKAc485ysgAAAsAwggK8Bgkqhkig9w0BBwagggKtMIICqQIBADCCAqIGCSqGSIb3DQEHATAeBglghkgBZQMEAS4wEQQM9kdnIlmF9FnNtq28AgEQgIICc1nyMSQv2S_LoPvfqWnxolcaWwHcMvzAhYJaL0BRqiD-ptOSY2s9xlAY_Has_8JWx6coRdiyYwccEF06fAl6IFOT3xk0LeSRY0052DqZb-EtdbzAwmG2OBxFr5m4kIfnPnKs3Zz4Zglmfbgwffxp WVKYw9mCGv7t1Zd4u3zpf9ep8xjDVOoPJgT_2XupVApqsn0TNEUsn09TWHoqJxu9en5_V2W9MEBQPyR9AmoXiMrXMqtzohC9PX4UcidfrDHZizWpugGUfztZlT6hUQNeReyrurlWLq9fSH3cNDEbPBen_YGU_CzCXtKd8eOGCkABB5nLKTAtMdgQ2z5DaNY8xSN09XKLoj5sKBy-VU5ioNBVgzwb5NenSs0792tk9-Xej3cbl3wyOAn14OzzsNeA033BXDyMUbTousomkyxNBLLwTx4EZ3smjpJpmawzXklynICUSMinAY07t_AwiKN-Op1b3QtBQjkZesC4DNblPbm9CgXaiEhN5hfZXXJVhqE3ShugHkvhNYJ8hYbKj_6QUUVCNIv3ovB9sZbBVWt_E5MxsYnase-TaPuUqTZREpRK2yCZOWY_lQc1fyStTzSDuve7w5-WAWJeKZL8z1Dz_mbqqyBm-V37wY5HwQs8hOGHvRVCMGmoq2W23bvD8dG6AFn056Df-vaB5BR-87UEb1AiCimN_FhFddO9IEqH3YTEdM1k1huVIrxFgplzXNX-gCqpjTDnZ-RlZeE6BokQkGU_r1X3CtprGZ5XrqvJRCnLYdrSt6HMe9a96s7uO34ST31QmOZRrJT0VIr-8jeLdOh333qsWxZNxzUNExcIg1yOHMRvVg , reproduced from *Holocaust and Genocide Studies*, vol. 18, no. 1, (Spring 2004): 68–103. Thanks to Patrick Kroker for this information.

4
David Irving v. Penguin Books, Day 11 https://web.archive.org/web/20151220161551/https://www.hdot.org/en/trial/transcripts/index.html .

5
That was Robert Faurisson. Van Pelt, *The Case for Auschwitz*, 3ff., 24ff., and 458ff.

6
Keren, McCarthy, and Mazal, "The Ruins of the Gas Chambers."

7
For van Pelt this "negative evidence" demonstrated the opposite: that the Nazis were covering their own traces; they were the first deniers, he explained. He stated that none of the drawings of the gas chamber showed the holes, because the architects were not allowed to draw in these pieces of incriminating evidence. In any case, the absence of evidence was certainly not evidence of an absence.

8
David Irving v. Penguin Books, Day 10 https://web.archive.org/web/20150211103915/https://www.hdot.org/en/trial/transcripts/index.html .

9
Dino A. Brugioni and Robert G. Poirer, "The Holocaust Revisited: A Retrospective Analysis of the Auschwitz-Birkenau Extermination Complex," February 1979 http://www.globalsecurity.org/intell/library/imint/holocaust.htm .

10
Irving was referring to a 1992 study by John C. Ball. See Van Pelt, *The Case,* 56.

11
Van Pelt, *The Case*, 84 and 353.

12
David Irving v. Penguin Books, Day 11 https://web.archive.org/web/20150211103915/https://www.hdot.org/en/trial/transcripts/index.html .

13
The relation between the single pixel and the human figure is a constant challenge in aerial and satellite image interpretation. The Tolimir case, one of the last of the Srebrenica cases judged at the ICTY (decided 2012, currently on appeal), has the following quote in regards to an aerial images of the Nova Kasaba soccer field. The Trial Chamber accepted the explanation of the witness on identifying darker pixels as people rather than shadows as claimed by the accused: "THE WITNESS: I have spent numerous and numerous hours analysing all these pictures and identifying what reference they can have on the ground ... It's a football field. There are no bushes in the middle. So these grey zones are not shadows. Though, indeed, a shadow has the same pixel than a group of people on the picture, but if you compare what is officially said on the photograph and the corroboration you can make of what a man represents in terms of a pixel on such a photo, this is why I allow myself to say that the dots that I have marked previously are people." (March 29, 2010, p. 933, witness Ruez http://www.icty.org/x/cases/tolimir/trans/en/100329IT.htm .)

14
His evidence also included the interpretation of architectural plans drawn from the archive of the Auschwitz Central Construction Office, aerial photography, letters, diaries, logbooks, testimonies, and ground-level photographs. On Van Pelt's evidence, see also: Debórah Dwork and Robert Jan van Pelt, *Auschwitz, 1270 to the Present* : *A History* (New York: W. W. Norton & Company, 2002); Robert Jan van Pelt, *Architectural Principles in the Age of Historicism* (New Haven: Yale University Press, 1993); and many other articles and essays.

15
See http://www.forensic-architecture.org/ .

16
The investigation was undertaken on behalf of various political and legal groups and was presented at the UN General Assembly in 2013 by the UN Special Rapporteur for Counter Terrorism Human Rights, Ben Emerson. The work was also presented in the context of legal action brought about by Pakistani lawyer Shahzad Akhbar in the UK Court of Appeal and in collaboration with the Bureau of Investigative Journalism (BIJ). The team was coordinated by Susan Schuppli (research and coordination), Jacob Burns (research), Steffen Krämer (video compositing and editing), Reiner Beelitz (architectural modeling), Samir Harb (architectural modeling), Zahra Hussain (research assistance), Francesco Sebregondi (research assistance), and Blake Fisher (research assistance). Some cases were undertaken in collaboration with Situ Research. Other partner organizations included the European Center for Constitutional and Human Rights (Andreas Schüller), One World Research (Bridget Prince, Nasser Arrabyee, and Anis Mansour), Al Jazeera English (Ana Naomi de Sousa), Chris Woods (freelance journalist), Edmund Clark (photographer), Chris Cobb-Smith (munitions expert and consultant), and Myra MacDonald (freelance journalist).

17
See Weizman, "665: The Least of All Possibl Evils," *e-flux journal* 38 (October 2012) https://www.e-flux.com/journal/38/61213/665-the-least-of-all-possible-evils/ ; and *The Least of All Possible Evils: Humanitarian Violence from Arendt to Gaza* .

18
The US 1998 Land Remote Sensing Policy Act. In 2014, after lobbying by satellite companies, American satellite companies were allowed to provide images in a slightly sharper a resolution—about 30 cm/pixel. They successfully argued that private identity would still be masked at this resolution. See "US lifts restrictions on more detailed satellite images," BBC, June 16, 2014 http://www.bbc.co.uk/news/technology-27868703 . The European satellite Pléiades, unaffected by the American restrictions, has since the end of 2011 provided 50 cm/pixel images of Palestine/Israel. See also Hito Steyerl'sbeautiful film *How Not To Be Seen: A Fucking Didactic Educational .MOV File* , 2013. The size of the pixel in relation to the size of the body makes camouflage unnecessary.

19
In a further radicalization of the geopolitics of resolution, US satellite image providers make an exception to the 50 cm rule in Israel and the Palestinian territories it occupies. An amendment to the US Land Remote Sensing Policy Act, which sets the permitted resolution of commercial US image satellites, dictates that these areas are shown only in a resolution of 2.5 meters (later effectively eased to 1 meter per pixel) in which a car is made of two pixels and a roof—another common target—is depicted by 6–9 pixels. The snow screen placed over Israel's violation of Palestinian rights in the West Bank and Gaza contributed to Turkey's decision,

after the Gaza Flotilla incidents, to send its own image satellite into space and make available 50 cm/pixel images of Palestine/Israel. William Fenton, "Why Google Earth Pixelates Israel," *PCMag*, June 14, 2011 http://www.pcmag.com/article2/0,2817,2386907,00.asp Maayan Amir, "Gaza Flotilla," http://www.forensic-architecture.org/file/gaza-flotilla/ .

20
Heather Linebaugh, "I worked on the US drone program. The public should know what really goes on," *The Guardian*, December 29, 2013 http://www.theguardian.com/commentisfree/2013/dec/29/drones-us-military .

21
The Federally Administered Tribal Areas are officially a "Prohibited Area" for which nonresidents require special permission to enter. A complete list of Prohibited Areas can be found here, in Annex 1 https://web.archive.org/web/20120710192741/http://www.pakresponse.info/Portals/0/Policy/List%20of%20Updated%20Open%20and%20Prohibited%20Areas%20in%20Pakistan%20-%20%206%20January%202011.pdf .

22
Jacob Burns, "Persistent Exception: Pakistani Law and the Drone War," in *Forensis: The Architecture of Public Truth* , ed. Forensic Architecture (Berlin: Sternberg Press, 2014).

23
Rachel Maddow, "Victims of secretive US drone strikes gain voice in Pakistani lawyer," *MSNBC,* June 29, 2012 http://video.msnbc.msn.com/rachel-maddow/48022434#48022434 . See also Rabih Mroué, *The Pixelated Revolution* , 2012.

24
This situation recalls the photographs secretly taken by prisoners in 1944 inside one of Auschwitz-Birkenau's gas chambers. A large part of the image is a thick black frame—the room—because the light is calibrated to the outside. Beyond the door of the gas chamber, dead bodies are seen being burnt. Often when used in books and articles about the Holocaust, the dark frame is cropped off. In his seminal reading of these images, George Didi-Hubermann objects to this cropping because for him the frame is a crucial part of the image: not only is it the only

documentation of the interior of a gas chamber, but it testifies to the mortal danger in taking this image http://en.wikipedia.org/wiki/Sonderkommando_photographs#/media/File:Auschwitz_Resistance_280.jpg . Georges Didi-Huberman, *Images in Spite of All: Four Photographs from Auschwitz* (Chicago: University of Chicago Press, 2012).

25
In the same way that human bodies created voids in the ash layer over Pompeii, or that a nuclear blast famously etched a "human shadow" onto the steps outside the Sumitomo Bank in Hiroshima.

26
This process of mediation based on embodiment recalled other experiments in "situational awareness" undertaken in the context of US military immersive training environments and post-trauma treatment as captured in Harun Farocki's *Serious Games* (2009–10).A classic predecessor to this practice is narrated in Frances Yates' magnum opus about the Roman and medieval tradition of mnemonic techniques. *The Art of Memory* emphasized the relationship between memory, architecture, and destruction. Frances Yates, *The Art of Memory* (London: Pimlico, 1992).

27
Deborah Brauser, "Novel 'Avatar Therapy' May Silence Voices in Schizophrenia," *Medscape*, July 3, 2014: "Avatar therapy allows patients to choose a digital face (or 'avatar') that best resembles what they picture their phantom 'voice' to look like. A therapist, siting in a separate room, 'talks' through the animated avatar shown on a computer monitor as it interacts with the patient."

28
As such, both these testimonies exemplified the power of *parrhesia* . Michel Foucault took *parrhesia* to be the courage to risk one's life in order to speak an unpopular truth. The parrhesiastes "is always less powerful than the one with whom he or she speaks. The parrhesia comes from 'below,' as it were, and is directed towards 'above' (literally) ... and in its extreme form, telling the truth takes place in the 'game' of life or death." Michel Foucault, *Fearless Speech*, trans. http://www.amazon.com/s/ref=ntt_athr_dp_sr_2?_encoding=UTF8&field-author=Joseph%20P

earson&search-alias=books&sort=relevancerank (New York: Semiotext(e), 2001), 15–16; and Michel Foucault, *The Courage of Truth* , trans. http://www.amazon.com/s/ref=ntt_athr_dp_sr_2?ie=UTF8&field-author=Graham+Burchell&search-alias=books&text=Graham+Burchell&sort=relevancerank (New York: Palgrave Macmillan, 2011).
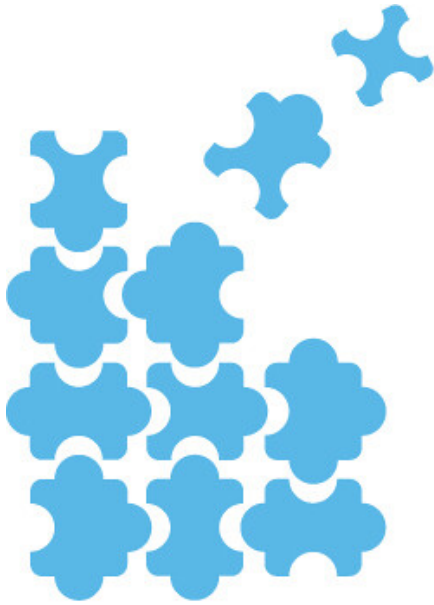
Philip Ursprung

Out of Bologna: Lacaton and Vassal's Nantes School of Architecture

On a rainy day in spring 2014, I visited the Nantes School of Architecture designed by Lacaton & Vassal Architects. Opened in 2009, it was the result of a competition held in 2002 to replace the original school from the early 1970s, which had become too small to house the expanded study program and the growing number of students. The Nantes School of Architecture is one of about twenty Ecoles Nationales Supérieures d'Architecture in France, and houses about one thousand students. I had heard a lot about this project and seen many images, but I had difficulty imagining its spaces and wanted to see it for myself. It is located on the Ile de Nantes, the former harbor area of this busy and wealthy city in northwest France. It is close to the old city center. Its neighborhood features the mixture of offices, housing, cultural venues, and vacant lots typical of gentrified waterfront areas, with their aura of both factory ruin and construction site.

As I approached the building, I was struck by the way it relates to the ground. The asphalt from the street seemed to continue seamlessly into the entry hall. And in fact there is no underground construction—the reinforced concrete grid sits directly on the ground. Heading towards the entrance, I passed by a ramp which gently leads to the upper decks and which can be used by pedestrians and bicycles, but also cars and trucks. The motif of traffic animates the entire space of the school. Circulation literally seems to be running through the various floors. Instead of planning a separate parking lot at a distance, or hiding it underground, the architects intertwined parking, teaching, learning, and administration. By declining to build a cellar, an attic, and a subterranean parking lot, the architects put all the features of a school's life on the table. The way of working is part of the work, so to speak.

As I went up the ramp I had the impression of entering the school through the back door. I immediately became sympathetic to the building. Instead of being dwarfed and intimidated by a monumental entrance structure, as with many institutions of higher education, I felt like an insider, like someone who knew the shortcuts, who was familiar with the place and was free to approach its entrance via the garage. Almost like entering a private flat where bicycles and kids' rubber boots clog the entrance, I was part of a non-ceremonial transitional area between outside and inside, public and private, a common zone where students and teachers, administrators, and passersby meet.

I found it easy to navigate the building and orient myself. Unlike most universities—for instance, my own in Zürich—where a Kafkaesque labyrinth of corridors absorbs one's energy, I never felt lost. Connections were simple, and some spaces, such as the main lecture hall, could be perceived from various parts of the building because their volumes intersected with the other spaces in the school. Mostly, I experienced my visit as an aesthetic pleasure, as a *promenade architectural*— an itinerary full of surprising vistas and spatial events. The

The Nantes School of Architecture designed by Anne Lacaton & Jean Philippe Vassal. © Lacaton & Vassal. Photo: Philippe Ruault.

EUROPEAN
Higher Education Area

The European Higher Education Area (EHEA) was launched in March 2010, marking the ten year anniversary of the Bologna Process.

rather narrow entrance area, with its dark floor and slightly somber atmosphere, opened up in a spectacular fashion to a very generous two-story mezzanine, which serves as an exhibition space and links the class areas to the library and the administrative offices. The architects work with contrasts of dark and light-filled zones, narrow and wide spaces, low and high ceilings, ramps, and stairs. There are many spectacular views, for instance towards the very large workshops which connect directly to the street so that cars and trucks can enter.

The most unexpected view is the one from the roof terrace over the river and towards the city. The terrace is a generous parking deck accessible both via the ramp and the stairwells. I immediately recalled the emblematic photographs from the newly built Bauhaus in Dessau in the late 1920s, with students and teachers dancing and playing music on the roof terrace, triumphing over the old Beaux-Arts education. Although it was pouring rain and everybody remained in the classrooms, I had no difficulty imagining students gathered in groups under the open sky, discussing their work, questioning the teachers, or enjoying a party after exams. It was easy to imagine how the curriculum worked, with the building alternating between lecture halls, drawing rooms, places to read, and places to relax.

The counterpart of the roof terrace is the main lecture hall

on the ground floor. With its asymmetrical seating and balconies, it resembles the interior of an opera house. The outer walls are covered with polycarbonate sheets, and curtains block the light if needed. The entire façade is made of sliding doors and can be opened towards the street. Whereas the publicly accessible roof links the building to the sky, the lecture hall links it to the ground. I imagined how teaching would function in such a situation, with people oscillating between the inside and outside of the school. In my euphoric mood of relating everything I saw to the realm of ideas, I recalled the opposition between Platonic and Aristotelian philosophy, depicted by Raphael in his *School of Athens*, with Plato pointing towards the sky and Aristotle to the ground.

Beyond Sustainability

In fact, there is much to be said about the aesthetics of Lacaton & Vassal's architecture, the formal quality of the spaces it produces—the materiality, the iconography, and the scenography. The overlapping surfaces alone offer a huge variety of spatial and chromatic experiences. There might be merely functional and economic reasons to install cables and tubes openly, instead of hiding them behind a concrete wall or under a ceiling. They simultaneously distinguish the building from and relate it to its surroundings, making it look extraordinary and ordinary at the same time. Something similar can be said about the membranes. The opaque polycarbonate sheets, with their undulating surface frame, blur and distort the environment, allowing us to see it differently. During the day they produce innumerable effects of light and shade for those working inside the building. For those approaching it, these membranes open different perspectives on the inside, such as the concrete structure

The roof of the Nantes School recalls Bauhaus in Dessau. © Lacaton & Vassal. Photo: Philippe Ruault.

A view of the Nantes School of Architecture, from the Ile de Nantes.

supporting the auditorium seating, material stacked in the workshops, as if one were passing a series of *nature morte* paintings.

Perhaps I was driven to such formal associations because Lacaton & Vassal's work is usually described in very prosaic terms. Most interpreters of the project highlight the fact that Lacaton & Vassal Architects offer more space than the brief asked for. Instead of ten thousand square meters required by the competition program, they proposed almost double the space for the same price. The architects thus further developed the basic method they had established in their Maison Letapie in Floirac, France (1993), the University of Arts & Humanities, Grenoble (1995/2001), the House in Coutras (2000), and the Social Housing in Mulhouse (2005): expanding the usable space by adding cheap conservatories. Using a standard support system—known, for instance, from IKEA storage buildings, which allow for important loads—the structure is open to future rearrangement. No wonder that a central quality of their work is identified as "sustainability." As Nathalie Janson put it in a brochure published when Lacaton & Vassal received an award:

> Paradoxically, it is precisely this primal move to create excess space that makes the building ecologically, socially, and financially sustainable. The building's double-height unprogrammed volumes, designed at the architect's discretion, provide the school with adaptable and multifunctional spaces that will allow the building to be repurposed rather than destroyed and built anew.[1]

The Intangible Infrastructure of Higher Education

In the second half of the nineteenth century, higher education was one of the key issues in the emergence of the European nation-states. The young nation-states cherished science and technology as the main engines of economic progress and social coherence. They considered public universities to be the very basis of this process. The democratization of European nation-states during the twentieth century—especially in the second half of the century, with the establishment of the welfare state—led to a rapid expansion of higher education. Many new universities and research institutes were founded, with new campuses built in and outside cities. The tension between the idea of higher education as a privilege for a small elite and the need to include a large part of the population in the "mass university" marked the discourse on higher education in the boom years after World War II, and was one of the reasons for the student revolts of 1968. Since the new millennium, Europe has once again been expanding higher education, now erasing the difference between nation-states in the guise of the Bologna Process. In some European countries, such as Ireland, more than half the population had a tertiary education in 2013, and the European average is 40 percent.[2]

The "Bologna Declaration" of June 19, 1999 states that

> a Europe of knowledge is now widely recognized as an irreplaceable factor for social and human growth and as an indispensable component to consolidate and enrich European citizenship, capable of giving its citizens the necessary competences to face the challenges of the new millennium, together with an awareness of shared values and belonging to a common social and cultural space.[3]

The construction of a Europe-wide system of higher

education was considered necessary if European higher education wanted to acquire a "world-wide degree of attraction equal to our extraordinary cultural and scientific traditions"—in other words, to remain competitive with the private higher education sector in the United States and the dynamic development of higher education in Southeast Asia. The aim of the meeting was to achieve within a decade the objectives of having easily understandable and comparable degrees; a curriculum based on two main cycles, undergraduate and graduate; a system of credits; the promotion of the mobility of students, teachers, researchers, and staff; and assurances of comparable quality.

Opinions on the Bologna Process are divided. Most politicians applaud the process because of its role in advancing the unification process in Europe and its promise of making research and teaching manageable. Without a doubt, the Bologna Process has made students more independent of the arbitrariness of professors, offering them more mobility and clearer rules. Students can more easily plan their studies and change schools, and the experience of living abroad for a semester or two is advantageous for their life and career. While the majority of students favor the Bologna Process, most professors are skeptical. Particularly in the German-speaking areas of Europe—Germany, Switzerland, and Austria, with their long tradition of federalist, decentralized higher education—not only professors but also a growing number of administrators and university representatives harshly criticize the process. According to its critics, Bologna is a failure. It has increased workloads and the influence of bureaucracy, and it has diminished individual autonomy and the motivation and intellectual curiosity of students. The "employability" of European students being one of the main goals of the process, the mainstream of left-liberal academics deplores the economization of higher education. Instead of preparing students for their lives, say these academics, the system turns them into ETCS (European Credit Transfer System) hunters.

The "Bologna Process," or simply "Bologna," is named after the city where the first meeting about the education reforms took place. Bologna is also home to one of the oldest universities in the world. But the Bologna Process does not have a face. What is the role of architecture in this process? Is there a spatiality of the transformation of higher education? Is there an architecture that depicts "Bologna"? While the mantra of urbanization has replaced the ideology of progress, and while we hear often about the growth of urbanization—"10 percent of the population lived in cities in 1900, 50 percent are living in cities in 2007, and 75 percent will live in cites in 2050"[4]—the growth of academization seems to be detached from issues of architecture and urbanization. The influential book *The Endless City* is exemplary of the ongoing trend of focusing on the city. It features reams of data about economics, density, and mobility in cities, but the topic of

higher education is neglected; the index does not even mention the word "university." In the architecture world there are, admittedly, sporadic discussions about issues such as the urban campus, individual signature buildings at research institutes, and libraries or student housing.[5] But such projects concern mainly specialists and are overshadowed by more spectacular manifestations of architecture such as stadiums, concert halls, and museums, and more appealing topics such as ecology, gentrification, and densification.

I would argue that the role of architecture as intangible infrastructure in the realm of higher education is both crucial and repressed. Perhaps the utilitarian nature of the spaces of higher education stands in the way of perceiving them as elements that are of interest to architects. The spaces of lecture halls and libraries, admission offices and photocopying booths, gym halls and bicycle stands, cafeterias and computer rooms, inform the daily life of students and teachers. Yet the constant transformation necessary for their functioning, the adaptation to changing numbers of students, the reshuffling of institutes and chairs, the permanent reorganization of staff hierarchies—these factors make the spaces of higher education unattractive to Architecture with a capital "A." Unlike political institutions and private companies, there is little need for higher education to be "represented" architecturally. Unlike private universities, which traditionally commission buildings by famous architects and attract students with the visual quality of their spaces, there is no such thing as a brand in the realm of public higher education. Both the "corporate identity" and the "façade" are secondary in a field where value is measured by reputation, trust, and credibility, and is expressed in rankings lists.

This might be one of the reasons for the indifference of most higher education officials to the quality of the architecture on their campuses. The other reason is probably political: since public universities depend almost entirely on taxpayer money, they try to prevent the impression of wasting it on anything that is not entirely necessary. This indifference to the architectural expression of higher education is not unique to our present situation, but goes far back in history. In his dissertation about the early history of the University of Leiden, Gregory Grämiger wrote that at the time of the university's founding in the late sixteenth and seventeenth century, the focus was on the transformation of already existing buildings—namely, a church—in order to provide useful spaces for libraries, exhibition spaces, laboratories, and an anatomy theater. There was neither a budget nor a need to invest in the exterior look of the newly funded university. In order to attract students, it relied on word-of-mouth and on prints showing the laboratories, the library, and the fencing hall. The exterior aspect of the university, and its architectural quality as a whole, was neglected.[6]

Trucks in the Classroom

There are two conflicting principles battling for the soul of the Bologna Process. One is economic. From this perspective, the Bologna Process is about exploitation under the conditions of immaterial labor, about preparing students for the market, about standardization, interchangeability, homogenization, profitability. The other is idealistic. From this perspective, the Bologna Process is about emancipating students from the professorial hierarchy, about social and spatial mobility, about mutual tolerance and experience, about the sharing of knowledge, about unity and a better future. In the "Sorbonne Joint Declaration" of 1998, which predates the Bologna Declaration, the ministers of education in France, Germany, Italy, and the United Kingdom stated:

> The European Process has very recently moved some extremely important steps ahead: relevant as they are, they should not make one forget that Europe is not only that of the Euro, of the banks, and the economy: it must be a Europe of knowledge as well.[7]

It is exactly these two conflicting principles that can be perceived in the Nantes School of Architecture, a project whose history—from the design competition in 2002 to the building's completion in 2009—runs more or less parallel with the Bologna Process. Or, put differently: while the conflict is difficult to articulate on a conceptual level, it is manifest in the spatiality of the school. The constant questioning and open-ended adaptability of the building is intrinsically linked to the Bologna Process. Indeed, the architects emphasize these values in their own description of the building:

> On the initiative of the students, teacher or visitor, these spaces become the locus of possible appropriations, events, and programming. At any one moment the adaptation of the school to new interventions and its reconversion is possible. Like a pedagogical tool, the project questions the program and the practices of the school as much as the norms, technologies, and its own process of elaboration.[8]

Couldn't the building itself be read as an allegory of the Bologna Process? Its location on the Ile de Nantes makes it appear as if it emerged from the *terrain vague*, from the ruins of deindustrialization. With its concrete grid reminiscent of warehouses and factories, it resembles a reused industrial building.

But as one walks through the spaces of the school, it becomes obvious that there is no dialogue between old and a new. Rather, the building is about an interaction between architecture and infrastructure. The collision between its highly refined composition of spaces and materials, and the robustness of its infrastructure, produces a tension that cannot be resolved. It is an internal contradiction that is also characteristic of "Bologna" and other processes related to the European Union. Like the brutalism of many buildings from the 1960s and 1970 that were intrinsically related to the welfare state, the Nantes School of Architecture resonates with the spaces of European bureaucracy in "Brussels" and "Paris," as well as with the innumerable investments in roads, bridges, and other traffic infrastructure that go with the European Union. To understand that traffic and higher education are inseparably linked is one of the lessons that one learns from visiting the school. The presence of transport containers on various decks of the school, of caravans in the exhibition hall, and even of a boat and a truck in the workshops on the ground floor, is revealing for a situation that is far beyond the era of the ivory tower.

"Bologna," in the end, means that studying gets cheaper. Europe gets more students for less money, in smaller spaces, in a shorter amount of time than before the introduction of the reforms. Architecture cannot change the political framework, but it can be conscious about the conditions, and it does not have to fully identify either with the client or the program. The Nantes School of Architecture demonstrates that architecture does not have to subscribe to the ideology of reduction, scarcity, and control, although it has to be conscious of it, letting us see more than what the political decision-makers say. It is therefore not only one among many places where future architects are trained. It is also a place where the autonomy of architecture is tested.

X

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1
Nathalie Janson, "Lacaton &
Vassal Architects: Sustainable
space makers," in *Nantes School
of Architecture, University
Building in France* (Zürich:
Holcim Foundation for
Sustainable Construction, 2011),
22–69; 26.

2
OECD data http://data.oecd.org/
eduatt/population-with-tertiary-e
ducation.htm .

3
"The Bologna Declaration of 19
June, 1999, Joint declaration of
the European Ministers of
Education." See the website
Bologna Process—European
Higher Education Area http://ww
w.ehea.info/ .

4
To A quote the from the cover of
*The Endless City: The Urban Age
Project by the London School of
Economics and Deutsche Bank's
Alfred Herrhausen Society* , ed.
Ricky Burdett and Deman Sudic
(London: Phaidon, 2007). The
book echoes both in rhetoric and
design OMA's book *S, M, L, XL*,
first published in 1995.

5
See Alexander den Heijer and
George Tzovlas, *The European
Campus: Heritage and
Challenges* (TU Delft, 2014).

6
Gregory Grämiger, *"Verortungen
von Wissen: Die Räume und
Sammlungen der Universität
Leiden, 1575-–1700* , dissertation,
ETH Zürich (manuscript), 2014.

7
"Sorbonne Joint Declaration: Joint
declaration on harmonizing of the
architecture of the European
higher education system, Paris,
the Sorbonne, May 25, 1998." See
the website Bologna
Process—European Higher
Education Area http://www.ehea.
info/ .

8
See http://www.lacatonvassal.co
m/index.php?idp=55 .

In a 1967 report published in *Eye: Magazine of the Yale Arts Association*, Charles Moore, chairman of the department of architecture at Yale University's School of Art and Architecture (A&A), spoke to a "marked shift" then taking place.

> Students and faculty have now become involved to an unprecedented extent, in real problems in all their complexity with a concern for social issues and more concern for its form and less concern for the shape of objects in it. To an increasing extent, design solutions are expected to come at least partly from interaction with the user rather than from the imposition of an architect's formal preconceptions. With the development of these concerns comes of course an interest in new tools which are likely to make design more responsive to the complex needs of the world around us.[1]

Felicity D. Scott
"Vanguards"

Moore identified two new streams of architectural research and teaching within the school related to this shift: on the one hand, the rising fascination with the computer and techniques it facilitated and, on the other hand, a series of initiatives directed towards poverty in America, projects then focused on Appalachia, New Haven, and Harlem. This nexus of computerization and "a concern for social issues" was then informing vanguard practices within architecture, giving rise to research—along with objects, systems, and spaces—affiliated, knowingly or otherwise, with the complex and multifaceted regulatory apparatus emerging to govern the built environment and populations within it.

While frequently situated as a radical or avant-garde departure from traditional formal and aesthetic concerns in architecture, the late-sixties engagement with information technologies and computerization as well as the rise of the "user" as an object of social scientific knowledge—all under the rubric of "responsiveness"—can also be read as symptomatic of the discipline's functionalist response to a period of rapid technological transformation and of tumultuous social change, for which it was indeed seeking new tools. In what follows I want to trace some instances from the late 1960s wherein the ambivalence of such "responsive" architectural strategies—resonating between attempts to forge departures from a dominant matrix of power and inscribing architecture more firmly within it—came to the fore at the A&A: at a moment when architects are again engaging the unstable forces of technological and material change while seeking new modes of social engagement, understanding the complex dynamics at work during this earlier period seems to warrant critical attention. Shifting fluidly and at times indistinctly between forging participatory environments and testing social and environmental control mechanisms, these ambiguous

experiments remind us of the complicated and politically charged milieu within which architecture necessarily operates and to which it contributes. If these dynamics were evident elsewhere, Yale during the remarkable period under Moore offers a particularly cogent case study of the difficulties of negotiating this milieu, and of the need to take responsibility for one's position within such a shifting matrix.[2]

Charles Moore and Felix Drury in collaboration with Kent Bloomer, Project Argus: An Experiment in Light and Sound Environment, Yale University's School of Art and Architecture, Connecticut, 1968. Photo: Joel Katz.

Complex Needs

At the time of his report, Moore and newly hired faculty member Kent Bloomer were, as Moore noted, launching the famous Yale Building Project (an initiative which continues to this day) with a spring 1967 studio for first-year Masters of Architecture students dedicated to designing, and in turn constructing, the soon-to-be-much-celebrated Community Center in New Zion, Kentucky. Drawing on the precedent (and often the aesthetic) of recent Yale graduates David Sellers and Bill Rienecke of "Prickly Mountain" fame, but redirecting those design-build activities from for-profit speculative housing ventures in rural Vermont to community buildings for low-income communities, students were encouraged to shift their attention from formal concerns to questions of social relevance and political engagement with less privileged persons and hence less familiar ways of life.[3] If widely championed as a radical pedagogical initiative, not all Yale students were satisfied that such missionary zeal translated into actually engaging community concerns and participation. When in November 1968 a group of A&A students founded an alternative student publication—a countercultural broadsheet titled *Novum Organum*—it opened with the dissident headline "Education for Alienation." Asking "What was Yale

Architecture trying to do in Kentucky?" and for whom, it outlined a very different picture of the venture; *Novum Organum* stressed instead the slippage between the project's avowed social concerns and its more evident architectural (and formal) ones. Rhetorically asking "Didn't you ever ask what they wanted?" the editors concluded:

> I don't think so. I can't say that we ever found out what they wanted, much less needed. And yet for some reason this didn't worry anyone … Our agreement to accept federal funds within the outline of their program released us from the need to ask basic questions; it let us get on with our work in actualizing the program and making architectural decisions.[4]

The question of to whom the architect listened and for whom they were working would remain at the forefront of dissident actions at the school.

New Tools

Soon after, when outlining the School's activities for 1968–69, Dean Howard Sayre Weaver stressed that "relevance" was to be understood not only in social terms but also in technological ones. In this respect too Yale sought to operate at the forefront of contemporary transformations, incorporating classes on "experimental architecture," film, and video into the curriculum and hosting an early World Game seminar run by R. Buckminster Fuller and faculty member Herbert Matter. As Dean Weaver explained,

> The term "relevance," much maligned and often facilely used these days, has a particular significance for this School. As America develops into a post-industrial, "technetronic" society, the impact of science and technology affects every aspect of the concerns and explorations of those who would aspire to assume responsibility for art and design—for pondering man's seeing and feeling and moving about, his relationship to his environment, and his conscious ordering of his physical circumstances. The artist, architect, and planner share today in discovering and accommodating to changes brought about by proliferating new capacities in communications and computer techniques. The challenge is not merely to adopt technology nor to inject modern gadgetry into art or practice. It is nothing less than to comprehend the changing nature of experience itself.[5]

This commitment to investigating the impact of a

"technetronic" society on architecture and the arts translated, in the first instance, into hosting an important early conference on computerization in architecture in April 1968, "Computer Graphics and Architecture," hence returning us to the other pole of Moore's "marked shift."[6]

Produced in conjunction with this event—which included technical and professional considerations of computers as tools for drawing—was an experimental inter-media installation: *Project Argus: An Experiment in Light and Sound Environment*. Designed by Moore and Felix Drury in collaboration with Bloomer, and constructed by students, *Project Argus* was, in the first instance, a two-story structure spanning diagonally across the exhibition and jury space in the A&A building. (It took place on the occasion of the tenth anniversary of a US atomic testing operation over the South Atlantic of the same name.) In retrospect *Project Argus* appears to have been something like a testing ground for Moore's prescient speculations on the emergent electronic environment, that "aspatial electronic world" which he identified in his contribution to *Perspecta* 11 of 1967, "Plug it in Ramses, and See if it Lights Up, Because We Aren't Going to Keep It Unless it Works."[7]

Charles Moore and Felix Drury in collaboration with Kent Bloomer, Project Argus: An Experiment in Light and Sound Environment, Yale University's School of Art and Architecture, Connecticut, 1968. Photo: Joel Katz.

Exemplary of changes in the school, this remarkable issue of *Perspecta*, edited by Peter de Bretteville and Arthur Golding, also included: "comprehensive anticipatory design scientist" R. Buckminster Fuller, experimental composer John Cage, media theorist Marshall McLuhan, experimental filmmaker Stan Vanderbeek, critic and then director of Fuller's World Resources Inventory John McHale, experimental collaborative Archigram, and "democratic" planner Paul Davidoff.

"No diagonal drawn in the 1960s was such a clear statement of rebellion against the past as Project Argus," announced *Progressive Architecture* critic C. Ray Smith, describing it as "a glittering, ambiguous room-within-a-room." As Smith reported, acknowledging that it was not simply a countercultural assault but a faculty initiative, it was constructed "to provide an 'open-ended experimental atmosphere,' Yale officials said, presumably in contrast to Rudolph's 'closed' exploded-pinwheel-plan structure."[8] *New York Times* critic Ada Louise Huxtable also read the installation as a frontal attack on former Dean Paul Rudolph.

> Yale architecture students agitated until their notably Supermannerist dean, Charles Moore, aided in the temporary destruction of one of the major areas of Paul Rudolph's Art and Architecture Building. They installed a pulsing white light display of fluorescent tubing and silver mylar for a space and mind-bending esthetic experiment and design *double-entendre* that practically told Mr. Rudolph to get up on the shelf and stay there.[9]

Forming part of the school's "Research in Programmed Environments" initiative, the structure served as the infrastructure for a hybrid (analog-digital) computer-controlled, ever-changing light, film, and sound environment programmed by the New Haven artists collective Pulsa.[10] To cite Smith again, "Project Argus housed and reflected film clips and an all-white light show, by Pulsa … The pulses, both aural and visual, and flashing superimpositions inflicted a dazzling bombardment."[11]

Illustrated by a bird's-eye view of the control panel driving this machine-enhanced perceptual bombardment, *Project Argus* was the subject of a front-page article in *Yale Daily News* that raised doubts not only about the primacy of its physical or architectural infrastructure but also about its liberatory character. The authors, Thomas Hine and John Coots, noted that the "slightly varied electronic hums and … constantly changing patterns of light reflected off the mirror-like mylar walls" produced an assault on the retina and perceptual distortion and went on to cite a series of responses to the encounter that implied the potential of a flip-side inherent to the fluidity of the environment: "I feel as though I am in a sort of trance with the lights and people sort of suspended." And, "I think it's dangerous, like the ultimate weapon. In the hands of some very unhip people it could do some dangerous things."[12] Under the heading "Panoptics Fill Yale Gallery," the *New Haven Journal-Courier* reported on Pulsa's performance on opening night, stressing the electricity coursing through the space and through bodies within it. "The electronic sound that came from everywhere, generated by audio oscillators, drove the lights—grasp one of the flickering

tubes in your hand; feel it snapping and pinging your flesh in time with the pulse of sound … Even the plastic mylar sheets were wired for sound—with electrostatic oscillators, one of the students said, tremoring to electricity that you could only hear."[13]

It was not only on account of the "almost painful flashing" of the strobes, the synesthetic effects, and the ambiguous feeling that something might be about to take place, that this experiment headed into ominous territory. "High above this scene," Hine and Coots reported, "were two men sitting among the cables and wires, their faces illuminated by the eerie glow of the oscilloscope on the control panel. And they controlled it all." The two Pulsa members—Paul Fuge and Bill Crosby (a kinopticist)—were in fact experimenting both with shaping space and with crowd behavior, shifting the mixture of lights and sounds, selectively activating speakers and other equipment, to elicit certain effects. Noting that sound as such was not the object of their experiment, Fuge said, "Tonight we're concerned with what the space is that it's shaping." But space as such was not their prime target. As the account continued, turning to questions of subjective control,

> [Fuge] changed the sound to a slightly lower intensity. In one alcove, a group carried out a little playlet.
>
> Fuge bent over the oscilloscope and upped the pitch and volume of the sound. Before, the sound had hit the solar plexus. The new high whine hit the throat. People tightened up downstairs. They stopped their humming, their laughing, and their acting. "I've got to go," one said, and all but a few left.
> The men continued to play with their lights, their sounds. The pulsa bent over his control panel, "Watch what they do now…"[14]

With oscilloscopes and other supplies derived from Army surplus warehouses, *Project Argus* blurs distinctions between experimenting towards spatial liberation and psychedelic experience through inter-media environments and behavioral control. Even if at play within an experimental school of architecture, its mechanisms of transformation and modes of "participation" operated on a razor's edge.

That such artistic practices harbored the potential of "applied" research was alluded to by Joel Katz in "Pulsa=Light as Truth." Imagining the future trajectory of their work, Pulsa member David Rumsey explained their departure from a traditional gallery environment:

> "Because of the kind of people it [the university] can attract," says Rumsey, "and because of its connection with the technological and business communities and

its accessibility to funds, the university is going to be the place where these things will happen. In fact, members of Pulsa anticipate the day when art will be supported by industry as a joint artistic-commercial venture, based on the premise that artists' experiments with new materials will suggest new forms of commercial application."[15]

Pulsa was not alone in pursuing applied agendas for art, nor was Yale the only institution sponsoring such collaborations. Take, for instance, USCO's formation of Intermedia Systems Corporation in association with Harvard Business School professor Dr. George Litwin, an initiative profiled in Stewart Kranz's 1974 anthology, *Science and Technology in the Arts*. "We are trying to use mixed media—multimedia technology—to create environments that have particular kinds of psychological effects," Litwin explained to Kranz. "We are talking about man's environment. It's been here all along. It's been influencing us all along. What we are saying is: we can begin to have some control over the environmental influences on our behavior, attitudes, and motivation."[16] USCO member Gerd Stern added: "We perform many experiments. We don't entirely know the reason why we are doing them."[17] Stern earlier explained of the collaboration, seemingly without apology, "The age of supporting art is over. The distinction between business and art is over. So, now we'll get better art and better business … Yes, it's legitimate to say Intermedia represents a blurring of the lines between psychology, business, art and some other things."[18] If Marshall McLuhan had imagined art to have the potential to produce counter-environments that would render lines of force more visible, comprehensible, interruptible, here was work vectored in the opposite direction.[19]

Applied Research

Architecture has long treaded the waters of applied and commercial research, and another initiative at Yale in spring 1968 falls within this rubric: the experimental plastic houses built by Drury and his students from polyurethane foam on the Yale Golf Course (and exhibited soon after in the Museum of Modern Craft's exhibition "Plastic as Plastic"[20]). As reported in the *New York Times*, although the foam houses were still in a "primitive stage," here was "a serious look into the future." The three houses were rapidly constructed by inflating balloons of plastic-backed burlap onto which was sprayed a few inches of a quick-drying plastic foam, creating a rigid and waterproof curved surface that could be cut into to create windows and doors. As student Daniel Scully noted, the domes were also easily transformed: "If you were living here and you had another kid, you'd just blow up another balloon for his room and spray the foam on it, all in an hour or so." The experiment was sponsored by Bemis
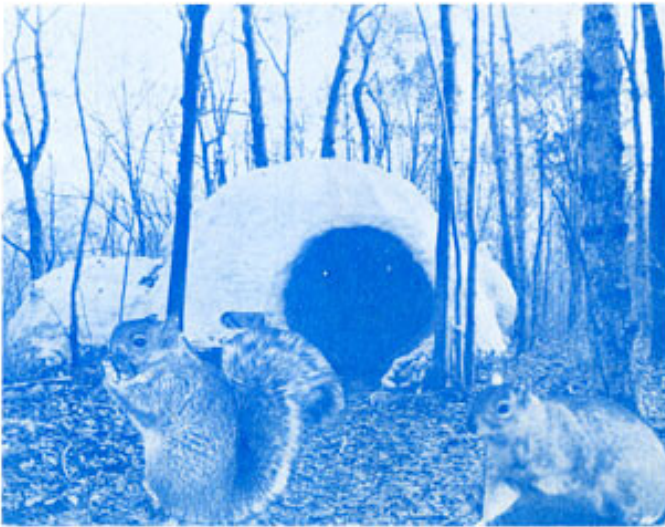
Manfred Ibel, "Experimental Houses for Squirrels," in Novum Organum (December 3, 1968): np.

Under the title "Experimental Houses for Squirrels," and accompanied by hilarious photo-collages, Manfred Ibel challenged Drury's approach of simply "playing with the material to see what can be done with it" and the imagined escape from the post and beam tectonic paradigm. "I think this is quite a naïve statement," he retorted, pointing out that this was hardly vanguard "in an age of electronic communication where young people are growing up in an environment of mobility, flexibility and change, with jet planes, geodesic domes, air-inflated structures, plywood, plastics, space capsules and rockets, automated machines, prefabrication, epoxy, instant shaving cream and mobile homes." Additionally he suggested that other cheap techniques were available, such as "the construction methods of the USA-frame-house-suburbia" and that "It seems that architects never want to concern themselves with the people who are going to live in their artifacts."[22]

That spring also saw Barbara Staffaucher's famous supergraphics studio, celebrated by *Progressive Architecture* and the *New York Times*.[23] As Huxtable reported in the latter,

> The students were to "explode" the dull box of the school elevator with color and pattern. Their painted designs were executed, two a week, until the end of the semester. Certainly no one in the building was bored. Designs ranged from a "peace elevator" with stars and stripes inside and the elevator doors sliding together to present the image of a bomber outside, to pure space-expanding experiments in fluorescent paint and flashing light.[24]

Company, Inc., which donated burlap, and Union Carbide Corporation, which donated the polyurethane foam and reportedly watched the experiment "with a great deal of interest." The students were, in effect, interpolated as a research and development arm for the corporation, testing the viability of Union Carbide's product for application in an imagined market for complex house forms. According to Drury the experiments simply helped participants "get away from the stick mentality—thinking exclusively in terms of the post and beam—so that students after they graduate will feel at ease with a material like this, and with its curved lines."[21]

As with the Yale Building Project in Appalachia, the foam plastic houses came under attack in *Novum Organum*. With $7,500 of foam donated by Union Carbide, they might well have irked students on the Left. But this was not, at least as stated, their main point of contention.

What was "upsetting older professionals" she concluded, pointing to the big, slick, dull work of large corporate firms, was "that the style is an architecture-destroyer—and what is destroyed, or mocked, is their architecture." To this she added: "What is really happening is that the upcoming generation, full of beans, talent, revolt and defensible disrespect for the tasteful totems of the huge, hack symbols of the establishment, is giving them a highly creative raspberry. You could call it productive protest."[25]

Productive Protest

Perhaps on account of their appeal to the rhetoric of the protest movement, the supergraphics experiments do not seem to have invoked similar ire from *Novum Organum*. There are, furthermore, other avenues of productive protest in New Haven that bear upon this story. For instance, as chronicled by Henry Stone in *Novum Organum* 1 under the title "Walkout," Yale students initiated a militant response to the insufficiencies of the American Institute of Architecture's definition of the

22. Barbara Stauffacher Solomon: Elevator design problem given to Yale architecture students, New Haven, Connecticut. 1968. *Photographs by James Righter.* (See page 290.)

Barbara Stauffacher Solomon, elevator design problem given to Yale architecture students, Connecticut, 1968. Photo: James Righter.

profession. In advance of the upcoming 1968 AIA convention, "an act of censorship (the walkout) was planned to repudiate the Institute and its goals, and an alternative conference set up that we might start to redefine the profession for ourselves." The students stated their concerns and walked out as well as outlining a list of resolutions including, among other clauses, "We will only use our skills as tools for liberating oppressed peoples ... The architect's only responsibility is to the people who *use* the environment ... We will work for equal distribution of economic power, work against such U.S. activities as the war in Southeast Asia, or any imperialist or racist exploitation at home and abroad."[26] The students did not consider Moore's pedagogical initiatives to have gone far enough and they organized and struggled for input into the school's transformation, fighting for an increased voice in the administration, choice of coursework, and admissions policies of the school.[27]

Novum Organum 3 (its cover replete with graffiti collected from the walls of the A&A toilets) also reproduced a list of recommendations to the dean to upgrade the faculty, whom they deemed "of limited diversity, mediocre quality and small and unvoiced activity."[28]

Art and Architecture students carry a coffin containing the unknown A & A student on their way to a mock funeral at Beinecke Plaza, Yale University, Connecticut, in Yale Daily News, 1969.

Sited in close proximity to poor African American communities in New Haven, Yale remained a bastion of white privilege. Under Mayor Richard Lee, the city was subjected to one of the most violent and racist urban renewal programs in America.[29] As Tom Williams recounts,

> In August 1967, the city erupted in five days of rioting that caused millions of dollars of damage and marked

an early and salient sign of an impending national crisis. This inaugurated an era of "street fighting pluralism" that served as a backdrop for much of the school's activism and culminated in the turmoil that accompanied the New Haven trial of Bobby Seale and other Black Panthers in 1970.[30]

Brian Goldstein has detailed the ways in which the university was complicit with the urban renewal programs that proved so devastating to poor, black, inner-city neighborhoods. Like Eero Saarinen's Morse and Stiles residential colleges and Philip Johnson's Laboratory of Epidemiology and Public Health, the A&A building itself, he explains, was constructed within the city's Dwight Renewal Area, hence forming part of a story of collaboration between the city and the university to facilitate displacement of existing populations. In response, in 1968 ten African American students founded an interdisciplinary group called the Black Workshop as "a radical alternative to the traditional Yale design education."[31] Faced with ongoing injustices, Goldstein writes, students "demanded pedagogical changes that would help foster greater engagement with the people whom architects and planner served," calling for "greater engagement with their community, racial diversity in their profession, influence in university planning, and increased involvement in university governance."[32]

Guerilla Theater

One last episode: in May 1969, A&A students launched a very distinct trajectory of protests, seeking financial equity with other graduate schools. After the failure of an initial petition to President Kingman Brewster, on May 8 they turned to theatrical demonstrations, attempting to enter the Yale Art Gallery en masse, and staging a "live-in" within the A&A building to "dramatize," as Stone put it, "the seriousness of our situation."[33] The following day students launched acts of "guerrilla theater" on campus: around noon they staged a "mock burial" of a coffin marked "the unknown A&A student." As reported in *Yale Daily News*, "with a motorcycle escort, the hearse proceeded to Beinecke Plaza followed by a train of wailing mourners. The students then unloaded the coffin and, with great solemnity, lowered it down gently into the Beinecke sculpture court."[34] Four days later the theater continued with the students staging a mock-auction of paintings in the Yale Art Gallery with sales made in "bogus Brewster bucks."[35] The following week, as announced on the front page of *Yale Daily News*, the A&A was forced to suspend classes, including those needed for graduation, only weeks away.[36] The adjacent story that day was "Beinecke Lipstick," which recounted that a student group calling themselves the Colossal Keepsake Corporation had commissioned Claes Oldenburg's monumental sculpture *Lipstick (Ascending) on Caterpillar Track*, which was

erected as an act of defiance against Gordon Bunschaft's Beinecke Library.[37]

As Tom McDonough and Goldstein have recounted, faced with the failure of democratic transformations, students in the planning department were radicalizing at this time, not in the name of improving levels of financial support for the existing student body but to transform that student body, and hence the institution as such. Seeking to address diversity issues they sought, albeit to different ends than Moore, "to make design more responsive to the complex needs of the world around us." Attempts to increase the number of African-American students led not to Yale addressing concerns about racial bias but to Brewster's decision in December 1970 to simply terminate the program.[38] "And then in June 1969," Robert Stern lamented,

> fire at the Art and Architecture Building, the nightmare culmination of the protests of students against its strong forms, protests which had been a continuous threat since its opening in 1963. What had begun as an issue of form versus functional accommodation had expanded and matured, frighteningly, into the deepest ideological controversy of our time—to the question of elitism in culture.[39]

Networks of Power

In retrospect, we might say that what initially might have appeared as a field of vanguard architectural experimentation emerges as a more complicated response to the period's technological transformations and to rising urban security concerns when our viewpoint is expanded even just a little from the reception of architectural works and events within mainstream publications and historical narratives. What Moore called "real problems in all their complexity" or "the complex needs of the world around us" remind us, moreover, of the discipline's proximity to such historical forces and the sometimes ambiguous nature of its professional and ethical directive to respond. Whether we take experiments with computer-driven technologies, social-scientific tools for addressing questions of poverty and discontent, or new materials thought to harbor the potential to respond to new or flexible forms of life, each finds complex footholds in, and utility for, a broader matrix of power then fueling, and fueled by, the so-called military-industrial-academic complex and the multinational corporations who served to benefit from such innovation.

In recalling these stories from the late 1960s, my ambition is in no way to suggest that architecture either simply remains entrapped by its relation to such "complex needs

of the world around us," or that the discipline seek instead to avoid imbrication with emergent techniques of power and the larger apparatus through which they operate. This troubled and at times troubling imbrication is precisely what makes architecture so challenging and interesting and it can set a framework for certain potentials to open up. In contrast to simply celebrating vanguardism or instituting heroic narratives that effectively operate to silence such troubles, my aim is to underscore the importance of working to render more visible, and to critically engage with, those intangible or elusive forces informing architecture's technological, conceptual, and economic parameters. It is to insist, as I argue elsewhere, that it is precisely on account of being so thoroughly imbricated within this expanded matrix of power that architecture harbors potentials to interrupt, intervene within, or redirect it to other ends.[40] Relations of power, as Michel Foucault reminds us, are fluid, mobile, unstable, reversible. The problem, as he puts it, alluding to Jürgen Habermas, "is not to try to dissolve [power relations] in the utopia of completely transparent communication but to acquire the rules of law, the management techniques, and also the morality, the *ethos*, the practice of the self, that will allow us to play these games of power with as little domination as possible."[41]

X

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1
Charles Moore, "Departmental Reports: Department of Architecture," *Eye: Magazine of the Yale Arts Association* , 1967, 29.

2
When this research was initially undertaken it was not with the idea of writing on the Yale A&A as such, but in the context of understanding the school during the moment when the Australian architect Peter Corrigan was studying there.

3
See Richard W. Hayes, "Activism in Appalachia: Yale Architecture Students in Kentucky, 1966–69," in *Agency: Working with Uncertain Architectures* , ed. Florian Kossak, Doina Petrescu, Renata Tyszczuk, Tatjana Schneideer, and Stephen Walker (New York and London: Routledge, 2010), 21–31. Hayes recalls the importance of the initiative of three students—Tom Carey, Steve Edwins, and Robert Swenson—who had spent time in Appalachia and introduced the project in New Zion, Kentucky "as a possible extracurricular project to Moore, who instead decided that he would make it the design project for the Spring 1967 semester of the first-year class," teaching it along with Kent Bloomer, 26. See also "Out of the Atelier and Into Reality," *Progressive Architecture* XLVIII, no. 9 (September 1967): 166.

4
"Education for Alienation," *Novum Organum* 1 (November 14, 1968): np. The editors were Bob Coombs, Mark Ellis, Manfred Ibel, Herb Short, and Stuart Wrede.

5
Brochure entitled "Yale University School of Art and Architecture," 1968–69, np.

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See "Computer Graphics in Architecture: Proceedings of the Yale Conference on Computer Graphics in Architecture," ed. Murray Milne, (Computer Graphics and Architecture, Yale University, 1968).

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Charles W. Moore, "Plug it in Ramses, and See if it Lights Up, Because We Aren't Going to Keep It Unless it Works," *Perspecta* 11 (Fall 1967): 32–43.

8
C. Ray Smith, *Supermannerism: New Attitudes in Post-Modern Architecture* (New York: E. P. Dutton, 1977), 108–09.

9
Ada Louise Huxtable, "Kicked a Building Lately?" *New York Times*, January 12, 1969, 25, 28.

10
On Pulsa see Yates McKee, "The Public Sensoriums of Pulsa: Cybernetic Abstraction and the Biopolitics of Urban Survival," *Art Journal* 67, no. 3 (Fall 2008): 46–67.

11
Smith, *Supermannerism,* 108–109.

12
Thomas Hine and John Coots, "Light, Sound, People Make 'Argus' Happen," *Yale Daily News*, April 26, 1968, 1. It is not clear whom they are citing.

13
William Betsch, "Panoptics Fill Yale Gallery," *New Haven Journal-Courier,* April 11, 1968.

14
Hine and Coots, "Light, Sound, People Make 'Argus' Happen," 1.

15
Joel Katz, "Pulsa=Light as Truth," *Yale Alumni Magazine* XXXI, no. 8 (May 1968): 43.

16
Cited in Stewart Kranz, *Science & Technology in the Arts: A Tour Through the Realm of Science + Art* (New York: Van Nostrand Reinhold, 1974), 261.

17
Cited in Kranz, 262.

18
Gerd Stern, cited in Deckle McLean, "The Multi-Media Thing," *Boston Sunday Globe*, February 7 1971.

19
See Marshall McLuhan, "The Emperor's Old Clothes," in *The M an-Made Object* , ed. Gyorgy Kepes (New York: George Braziller, 1966), 90–95.

20
See *Plastic as Plastic*, ed. Sandra R. Zimmerman (New York: Museum of Contemporary Crafts, 1968).

21
William Borders, "Yale Students Mold an Experimental House of Plastic Foam," *New York Times*, June 16, 1968, R1. Drury later realized such a foam-plastic structure as a corporate guest house for the West Point Pepperell corporate headquarters in Langdale, Alabama, using a heavy nylon fabric manufactured by the corporation. See Felix Drury, "Foam Home," *Progressive Architecture* 52 (May 1971): 100–03.

22
Manfred Ibel, "Experimental Houses for Squirrels," *Novum Organum* (December 3, 1968): np.

23
See C. Ray Smith, "The New Interiors: Fad or Fact?" *Progressive Architecture* 49, no. 4 (October 1968): 150-58.

24
Ada Louise Huxtable, "Kicked a Building Lately?" 28.

25
Ibid.

26
Henry Stone, "Walkout," *Novum Organum* 1 (1968), np. See also *Perspecta* 29 and Brian Goldstein, "Planning's End? Urban Renewal in New Haven, the Yale School of Art and Architecture, and the Fall of the New Deal Spatial Order," *Journal of Urban History* 37, no. 3 (2011): 407–08.

27
Jim Swiss, "A & A School: Problems of Space, Student Power, Grading and Relevance," *Yale Daily News* , January 15, 1969, 7.

28
See "Notes from the Committee of 8," in *Novum Organum* 3, January 6, 1969, np.

29
On Urban Renewal in New Haven see Mandy Isaacs Jackson, *Model City Blues: Urban Space and Organized Resistance in New Haven* (Philadelphia: Temple University Press, 2008); Anthony Ward, "Resistance or Reaction?: The Cultural Politics of Design," *Architecture and Behavior* 9, no. 1 (1993): 48–49; and Goldstein, "Planning's End?"

30
Tom Williams, "Lipstick Ascending: Claes Oldenburg in New Haven in 1969," *Grey Room*

31 (Spring 2008): 122.

31
Goldstein, "Planning's End?" 410. See also Richard Dozier, "The Black Architect at Yale," *Design Quarterly* 82/83 (1971): 16.

32
Goldstein, "Planning's End?" 402.

33
Tom Warren, "A & A Students Camp Out to Protest Financial Status," *Yale Daily News*, May 8,1969, 1.

34
Tom Warren, "A&A Protesters Hold Mock Burial," *Yale Daily News* , May 9, 1969, 1. That night they "demonstrated at the opening night performance of the Yale Repertory Theater's 'Greatshot' by begging and selling pencils to dramatize their financial situation."

35
Tom Warren, "Brewster to Face A & A Demands," *Yale Daily News*, May 12, 1969, 1.

36
Tom Warren, "A & A Faculty Agrees to Suspend Academics," *Yale Daily News* , May 16, 1969, 1.

37
Williams, "Lipstick Ascending," 121. "The School of Art and Architecture had long been an enclave of activist sentiment in the midst of a conservative campus," he explains, adding "the monument's installation marked the culmination of a long period of protest that challenged the structure and administration of the program."

38
See Tom McDonough, "The Surface as Stake: A Postscript to Timothy M. Rohan's Rendering the Surface," *Grey Room* 5 (Fall 2001): 102–11; Goldstein, "Planning's End?"; and Harry Wexler, "The Yale Saga: From Admissions Bust to Final Solution," *Bulletin of the Association of Collegiate Schools of Architecture* 9, no. 3 (Autumn 1971): 3.

39
Stern, "Yale, 1950–1965," 56.

40
See Felicity D. Scott, *Outlaw Territories: Environments of Insecurity/Architectures of Counter-insurgency* (forthcoming from Zone Books).

41
Michel Foucault, "The Ethics of
the Concern for Self as a Practice
of Freedom," in *Ethics:
Subjectivity and Truth* , ed. Paul
Rabinow (New York: The New
Press, 1997): 298.