Representing Information: Envisioning the City through Data

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The constructed world is replete with information that governs and controls its organization. From railroads to highways, building codes to zoning regulations, the design and development of the contemporary environment is managed by strategies of physical and visual organization. Architects' interest in this globally networked environment is reflective of an increasing awareness and attention to the multi-variant world, one invested in infrastructural systems that support productivity in lieu of pictures[1] and is reflective of a new global and electronic economy based on intangibles – ideas, information and relationships.[2] The effects of these systems, once only theorized and simulated through abstract models, is given attention via the measurement, collection and processing of their effects.

Increased methods of gathering and collecting information have resulted in an unprecedented saturation of data – data that often reflects empirical and scientific measurement of previously impressionistic phenomena. During the 2008 Summer Olympics, the Spatial Information Design Lab at Columbia University developed technology to measure precisely air pollution throughout Beijing, finding a way to link the observed phenomenon of low visibility, haze and smog with scientific measurement. In the months leading up to the Olympic games, Beijing's poor air quality was a cause of concern for the participating athletes and visitors to the city and, despite varying assessments by the Chinese authorities that "fog (not smog) was responsible for the low levels of visibility around the city,"[3] the government put into place several initiatives to dramatically curb air pollution.[4] Leveraging the Associated Press's unrivaled access to the Olympic venues, SIDL partnered with journalists to measure air quality throughout Beijing for the weeks leading up to and during the summer Olympics. Journalists were given hand-held monitoring devices that tracked air particulate matter, CO2 and geographic location, allowing the press to gather air quality information in conjunction with their geographic locales. Maps of Beijing's air quality before and after the government restrictions produced an information graphic distributed throughout the AP network, giving the world access to China's impacts on air pollution. But while the data collected, measured and visualized yielded a convincing information graphic to demonstrate industrialization impacts on the environment, its results are less certain. Despite the clarity of the visual mapping, the description of the city, its industrialization and authority's role is less confident. "The causes and effects of air pollution comprise a complicated chemical recipe that is all too easily reduced to superficial observation (the color of the sky) or an abstract statistical reading from static instruments. Being able to recognize the experience of a city's air quality is a combination of highly localized as well as more regional effects that shift in intensity as one moves through an urban landscape."[5]

Describing fluvial data is difficult. Information gathered at one location doesn't give a comprehensive overview of the interdependent systems that influence a singular data collection point. As the Beijing Air Tracks project demonstrates, reducing the complexities and experiences of a city into its measurable components can simultaneous overwhelm as well as liberate the designer.[6] While new technologies have enabled new types of information to be gathered and shared about our envi-

ronment, the methods of mobilizing this knowledge into meaningful design projects remains unclear. Critics have condemned designers that confuse the geographic patterning of data as a site for architectural form, oscillating between data's formal history as potential 'abstract machines,'[7] or leveraging its mere presence as empirical justification to operate. Data's ubiquitousness, its proliferation and availability has produced an "increasing range of architectural and urban practices focusing on the mining of data related to built form and its occupation so extensive in its accumulation, description and transformation, that these data structures can themselves be seen to operate as both the context of, and model for, practices of the architect."[8] In its late 1990's conceptualization, MVDV's datascape projects leverage information visualization practices by diagramming the quantifiable forces that can influence or control the architects' work. As Winy Maas has described, "DataTown is only based upon data. It is a city that wants to be described only by information. A city that does not know any given typography, no prescribed ideology, no representation, no context. Purely huge, only data."[9] Perhaps this is why 'DataTown,' MVRDV's hypothetical city based only on information, is so formally unspectacular. Is the mere presence of data, its meaningful measurement and observation of the urban context, a sufficient design project?

Spatializing collected and measured data, not just formally representing it through the metaphor of a city, can open up new geographies and territories of previously unseen networked systems. Visualizing and spatializing information 'is the conceptual glue linking the tangible world of buildings, cities and landscapes with the intangible world of social networks and electronic communications. To design is to invent new strategies for visualizing information that make new interpretations possible.'[10] As we gain information about the world, practiced methods of representing knowledge are challenged, and we must invent representational techniques that reflect the fluvial, multivariate ways of recognizing these changes. Infusing the landscape with data represents a significant conceptual shift from representing the environment pictorially. As Edward Tufte described this similar transformation of map making, moving from the only descriptive map to one that also includes measured data, made a significant leap forward in mapping thinking. "To depict relations between any measured quantities, however, requires replacing the map's natural spatial scales with abstract scales of measurement not based on geographic analogy… To go from maps of existing scenery to graphs of newly measured and collected data was an enormous conceptual step."[11]

Visually describing this networked, infrastructural environment is problematic, as it requires reflexive, multi-scaled methods of representation. Data moves. It shifts, changes, and is fluvial. While all data is just that – data – it is through the culling and designing of information that allows the designers' voice to penetrate through the collection process. Rem Koolhaas described his own practice of using data collection as a way of building intelligence into a project, using diagrams as a way to build up 'not just a knowledge about architecture, but about the world, too.'[12] Representing information became a tool to look creativity at building form, but also at the "economics of a project, too. The Conde Nast diagram and how there is a potential for new magazines to be born continuously out of these intersections."[13] In this sense, the interest of the architect isn't relegated to just the data enriched site, city or specific building, but to the work of the industry it contains. As Keller Easterling has noted, "This architecture is not about the house but rather about housekeeping. It is not be about triangles and tauruses or motion trajectories, but about timing and patterns of interactivity, about triplets and cycles, subtractions and parallelism, switches and differentials. Architecture, as it is used here, might describe the parameters or protocols for formatting space."[14]

Data collection is mobilized into architectural practice by representation techniques that visualize previously unseen conditions. Architecture critic Barts Lootsma recognizes this as an architectural practice, noting that data "when visualized, [these forces] together form a new and more complex version of what the site plan used to be."[15] Representing abstract environmental conditions allow relationships and adjacencies between components to be understood and therefore designed. Data visualization becomes a way to position architecture, to recommend or discourage design, and to promote spatial agency. While recent methods of collecting information have become more sophisticated, more nuanced, and more attuned to the environment, the methods of data translation are where design creativity and architectural agency lie. It is through the translation of data collection into visual representation that give

architects ways of occupying information, and using this occupation to develop design strategies. Recent practices have engaged data visualization as a way to situate their design proposals, and while each have taken advantage of new methods of collecting information about their subjects, it is through data translation techniques that demonstrate different ways of occupying data.

CLARIFICATION

One technique for occupying information is to clarify the components of complex systems, graphically depicting the flows of information such as traffic patterns, landscape ecologies, or even economies. Simplifying and clarifying these adjacencies reveals new sites for design, visualizes new hierarchies and relationships, as well as relegates the designer to one of ultimate organizer. In clarifying the components, designers are able to render each part of the process in isolation, therefore allowing relationships between components to be more easily read and understood. This technique is useful as it allows designers to understand the interaction between parts.

Hilary Sample's research in "Sick City" investigates the spread of disease within the context of urban infrastructures, linking together technologies that track and measure disease deployment with corresponding architectural and urban responses. The research begins with the 2003 SARS outbreak and its impacts on Toronto, a city that responded by scanning incoming airport travelers with thermal imaging devices. "The health of cities depends on the critical relationships and actions between this 'local-global nexus' of monitoring organizations along with the structures and devices used for tracking and alerting, which exist as both physical and virtual infrastructures."[16] As the research explores the global spread of SARS and how the disease was tracked, and its ultimate development of Biomed cities across the globe, the drawings, diagrams and mappings represent techniques of clarification and exposure of this complex system of disease, agents, and urban infrastructure. The drawings focus on pulling apart these complexities, using exploded axonometric and measured urban info-graphics that at once describe the moving of individuals infected with SARS, and the urban health infrastructure that responds to the spread of disease. In one mapping, the logistics of a hospital and its urban context is pulled apart, demonstrating the relationship between spaces of hospital lobbies, emergency room locations, and transportation systems. In rendering the city through these essential elements, the designer develops a method of seeing the spread of disease in isolation. Rather than measuring the condition of individuals as they move in and out of the country's ports, Sick City looks at how disease infrastructure works as a system of parts. This system of spatial clarification is similar to the Noli map of Rome, ignoring other physical details and focusing instead on the medical spaces infected individuals occupy, using techniques of clarification to identify health infrastructure. Proposed projects are located in relationships to these clarified sites, responding to the essential health infrastructures identified through the measurement of disease across global urban populations.[17]

AUGMENTATION

Data reveals independent systems that can be linked together to expand and augment their functionality. Siting design as physical infill, infrastructural thickening, or conceptual expanse allows design to look across functions and programs to bring seemingly opposing practices together by augmenting and densifying existing systems. For these projects, design tactics amplify existing conditions, building upon current realities in order to secure their futures.

Lateral Office situates their work at the intersection of ecological and cultural systems, working between vast scales of regions and intimate scales of landscape measurement. Collected and / or observed data in these contexts is represented artistically, using the landscape not as a formal or topological site from where to situate design, but understanding it as a lively system of moving parts. Their design intervention can come at the scale of a building – for example, their proposal "Ice Link: Occupying the Temporal Seam,"[18] suggested a land bridge along the arctic International Dateline that collapses the geographic effect of neither here-nor-there territory, transportation systems, cultural events and ecological systems of ice collection. While elegant, the architecture of the proposed visitor's center and train station is given little attention. The success of the project is determined by its impacts on ecological systems – ice collection and melting, fish nodes for agricultural harvesting, located at the intersection of time, geography and cultural impulse. The proposal links together the

cultural opportunity to cross water at this unique geographic and time location, and augments the ecological collections below of ice harvesting and collection. It uses landscape instruments to collect ice, simultaneously addressing ecological imperatives while giving a location for social connections.

The drawings employed to describe these augmented systems are at once very large scale and very small scale – linking regional maps together with product illustrations. These systems are brought together with dashed lines and impressionistic backgrounds, at once giving the data map an atmosphere of place and site, while also allowing the instruments themselves to be linked together with similar line work and explanations. The graphic tools of atmosphere and lines make fuzzy jumps between locations – how these sites are linked together, exactly we're not sure – but the drawings themselves expand across techniques to make convincing, if not explicit, visual connections. Unlike clarification techniques, where pieces are rendered in isolation or collapsed onto one another, augmentation represents information through techniques of layering. Each one of these ideas has a similar representation technique affiliated with it – and those different techniques of representing data, collected information through the landscape, is at once useful and confusing. Layering and scale change allow the viewer to look ever closer without loosing the context of the surrounding condition.

SIMULATION

Designers envision new worlds through practices of simulation, expanding upon visual practices that test and expand upon known conditions. Through simulation, designers can test their knowledge under new conditions and requirements, allowing new information about the changing environment to depict future conditions.

Alan Berger's project on the Reclamation of the American West defines the design project as not one of architecturalized objects or finalized sites, but of an open-ended engagement with processes. The design project has agency of operation, not of form. In this project, representation is the critical notational method to describe the reclamation of the mined western American landscape in that it not about what the thing will look like in the end, but about a process that engages those ideas, identifies how these sites are currently being altered, and communicated. The way to intervene on the site is through sorting, projections – "hard data" is used to organize the sequence of events, these speculative mappings ask the reader to engage in an evolving discourse, a simulation with its potential future. "Mappings are more diagrammatic than dogmatic, more akin to discovery than recovery – more concerned with process than results."[19] While each mapping then can be described as 'double sided,' at first collecting the visual indicators of a mined landscape, then recording the landscape alterations that are visible or physically veiled. These diagrams reveal processes that are invisible to the form of the project – they document the social, environmental, financial and legislative processes, and render them concrete.

Alan Berger's drawings of the West mine's reclamation project clarifies data by collapsing various scales of information. Rather than isolate each component and draw relationships between parts as a dashed line or the all-transformative arrow, Berger compresses information as a way to draw relationships. Rather than registering discrete parts, it allows for an overall sense of the interconnection and scalar change of information to be presented. Working from the regional scale, presenting long-term statistical information about a project, while simultaneously spatializing and presenting the project with an image of the mine in its current configuration, the work oscillates between regional and building scaled projects, and looks at how these components affect and intertwine with one another.

REVELATION

When visualized, collected data reveals tactics, outcomes and agencies of visualizing geography and policy. Maps, diagrams and information reveal practices of power, demonstrating ways the cultural landscape physically reinforces social mores, exposing complex social networks and cultural practices within cities and territories that, unless decoded by the designer, remain unobserved to the naked eye. In these methods of data collection, the designer acts as ethnographer, reporter, or anthropologist to understand how the urban landscape is occupied, designed and controlled. While not overt gestures of form or dwelling, the close cultural observation of these sites, and their subsequent design projects and critical drawings, reveal new contexts to situate design.

Interboro Partners works in this method of social and cultural investigation, using their observational skills to identify voiceless constituents who may not solicit economic influence over given sites. Two projects demonstrate this method of on the ground data collection and subsequent revelation – their entry into The Dead Malls Competition[20] and their handbook "Improve Your Blot,"[21] included in the Shrinking Cities exhibit and publication. The "Improve Your Blot" project looks beyond the seeming emptiness of Detroit to acknowledge the density of land ownership. Using Google Earth in cross-reference with city cadastre maps, the project addressed land holdings, ownership, and the design projects that come from grouping new urban blocks together to form new "blots." This information is found as a result of direct observation, subsequent statistical collection of information across various government agencies, and first hand interviews with selected 'blot' owners. The technique employed in the "blot" project was one of 'ghost writing,' giving Interboro the opportunity to observe, investigate, and discuss property ownership with the owners themselves. The data collection is reflected through the development of a guidebook for neighborhood residents who may want to increase the quality of their land ownership. The book collects methods for designing and developing blots with simple architectural tools such as fences, porches, gardens and strategic siting, to improve the quality of their properties without overwhelming their budgets.

Interboro's first project, 'In the Meantime: Life with Landbanking," recognized the need to collect anecdotal information about a site, data that isn't always found in a GIS database. One drawing reflects the observed site conditions, anecdotal interviews with various mall users, and proposals for future. The map of the mall shows the mall in its current condition. After the mall constituents and their needs, using techniques of cartooning to develop and cull impressions and aspects of the mall, and then finally ringing the project with projections and proposals for its future, surround it. This drawing was an important one of Interboro, and it acknowledged the collapsing of first-person reporting into a project that links master planning with direct emotional impact of various stakeholders.

THE URBAN INFO GRAPHIC

Many of the projects described operate between scales of data collection methods and their subsequent visualizations. The methods of measuring and collecting information is less instrumental to design practice as are the resulting graphics that situate design. As a result, these practices wrestle with new scales of representing vast kinds of data collected about their environment. Designers have always used varrying types of drawings to describe their work, but as projects and firms absorb even wider and more abstract scales than plan, section or elevation reveal, new languages of representing and drawing information must be considered.

A new language of urban / global / information graphics have begun to infuse the urban diagram with critical tools that reflects the designer's intention, processes and development of a point of view. Diagrams are complex. While much has been written about their qualities as abstract machines, the intentions and usefulness of diagrams changes upon the context and point of view of the designer. Diagrams don't just operate as abstract machines – some very carefully do that – but others work at clarifying, revealing, augmenting or simulating data to allows for designers to operate in very different ways. Diagrams intentions have changed from their once ubiquitous bubble diagrams of the 1950's. Peter Eisenmenan's archelogical projects leveraged diagrams as 'double-sided tablets' that reified formal indexes in the city, bridging the anteriority and exteriority of architecture through a process of layering, folding and subsequent spatializing. The data collected in these projects were historic in nature, traces of grids and forms from previous histories that emerged as new conditions by which to find architecture. The data influencing these projects wasn't collected as much as it was discovered or recognized by preexisting formal forces in the city. MVRDV's use of "data scapes" leveraged the economic and statistical information of the city to develop 100% logical manifestations of Pig City and the sound barrier wall projects, abstracting information about the city into a form that was at once devoid of architectural detail and spatiality in lieu of an overall visual and architectural massing of "information." OMA's data collection and rendering spurred this new interest in information graphics, as programs and processes are intertwined to develop formal conditions as manifestations of data logic.

New generations of designers are leveraging information graphics in ways that are neither spatial nor indexical, but are gathering information and designing data as a way to resolve and compress complex

and conflicting sets of information. As our knowledge about the complexities of urban, landscape and building systems grow, and our responsibilities towards absorbing and addressing many different scales of spatial issues – from global health care to landscape mine restoration – and other opportunities that are both cultural, ecologic, and economic in nature, we must absorb these multi-scaled sets of knowledge into increasingly complex systems of collection, representation and proposal.

ENDNOTES

1 James Corner, 'Terra Fluxus', in Charles Waldheim (ed) *Landscape Urbanism Reader*, Princeton Architectural Press (New York), 2005, pp 21-33.
2 Michael Speaks, 'Design Intelligence and the New Economy,' *Architectural Record* (New York) January 2002, p. 72.
3 The Spatial Information Design Lab's website, <http://www.spatialinformationdesignlab.org/projects.php?id=97> accessed September 13, 2011.
4 ibid. "These included the removal of half of the city's 3.3 million cars from the road on alternate days; a temporary ban on 300, 000 heavily polluting trucks; the phasing out of older buses and taxis in favor of newer models that used compressed natural gas; higher emissions standards for new cars; the temporary shuttering of dozens of steel, chemical, and cement factories and power plants; doubling the number of subway lines; the pause in all construction activities throughout the city more than two weeks ahead of the games; and the addition of urban parks, or "greenbelts" throughout the city."
5 ibid.
6 Peter A Hall, 'Diagrams and their Future in Urban Design' in Marc Garcia (ed) *The Diagrams of Architecture*, Wiley (London), 2010, pp 163-169
7 Gilles Deleuze and Felix Guattari in *A Thousand Plateaus: Capitalism and Schizophrenia*, University of Minnessota Press (Mineapolis), 1987, p 144.
8 Brett Steele, 'Data (e)Scape", *Daidolos* (Berlin) 69/70, 1989/99, p 54.

Wouter Deen and Udo Garritzmann, 'Diagramming the Contemporary: OMA's little helper in the quest for the new', *OASE* (City) no.48, 1998, pp 31-43.
9 Winy Maas, 'Datascape: The Final Extravaganza," *Daidolos* (Berlin) 69/70, 1989/99, pp 48-53.
10 Janet Abrams and Peter Hall, *Else / Where Mappings*: *New Cartographies of Networks and Territories,* University of Minnesota Design Institute (Minneapolis), 2006, pp 12-17.
11 Edward Tufte, *Envisioning Information*, Graphics PR (Cheshire, Connecticut), 1990.
12 Brett Steele, *Super Critical: Peter Eisenman and Rem Koolhaas*, Architectural Association (London), 2007. These debates questioned, among other things, the use of diagrams in Eisenman's and OMA's practice.
13 Ibid.
14 Keller Easterling, *Organization Space*, MIT Press (Cambridge), 1999, p2.
15 Bart Lootsma, 'Reality Bytes," *Daidolos* (Berlin) 69/70, 1989/99, pp 8-21.
16 Hilary Sample, 'Biomed City,' in *Verb Crisis,* ACTAR (Barcelona, New York), 2008, p70.
17 Student work samples from Hilary Sample's "Sick City" seminar, Yale University, Spring 2010, in the exhibition *Exhibiting Organization,* Knowlton School of Architecture, The Ohio State University, November 5, 2010 – January 3, 2011.
18 Mason White and Lola Shepherd, "Pamphlet Architecture 30: Coupling: Strategies for Infrastructural Opportunism" Princeton Architectural Press (New York) 2011.
19 Alan Berger in Reclaiming the American West, Princeton Architectural Press (New York), 2002, pp. will have to check my notes
20 This project is best documented in *Praxis 8: ReProgramming* (Spring 2006), pp.24-30.
21 Both of these projects are well articulated by Georgeen Theodore, Interoro partner, at the conference Envisioning Organization: Architecture + Information, Knowlton School of Architecture The Ohio State University, November 6, 2010.