Data Urbis: Digital Processes of Analysis and Intervention in Contemporary Cities

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ABSTRACT

According to a 2008 report on world urbanization published by the United Nations, the number of people living in cities has surpassed the rural population for the first time in history. Furthermore, current projections (United Nations, 2008, 3) show that the majority of growth will occur in cities in the developing world, a tendency which will significantly contribute to the increased complexity of the urban environment. This paper is concerned with critically reflecting on the role of computation in the emergence of recent practices and strategies which intend to successfully confront the intricate performance of present and future metropolises.

KEYWORDS: digital design, cities, computation, urbanism; planning

The presence of digital technologies in urbanism is not foreign to designers, architects, and planners. However, since the inception of CAD in the late 1970s and early 1980s, the profession has, for the most part, approached the use of these tools with reservation, envisioning the computer as a powerful drafting and visualization instrument that bears the promise of ever-increasing efficiency in the process of representing projects.

In the early 1990s, advanced academic circles and design practices in architecture were engaged in rigorous research on the opportunities of using certain animation and motion graphic software packages that were popular at the time within the film industry. The fascination with these technologies was propelled, on the one hand, by access to increased computational power, and on the other, by a growing interest in issues of time, emergent systems, and self-organization, which had been motivated by the dissemination of the works of Bergson, Prigogine, and others. The city, understood as a field (Kwinter, 2001, 67) rather than a homogenous space, became the ideal research laboratory to conduct these experiments. By employing tools such as Maya particle systems designers attempted to simulate in the virtual world of the computer the complex behaviors observed in urban systems.

Given the urgency of addressing the problems of growing metropolises as well as of new urbanizations, it is crucial at this point to examine and debate the role of computation's creative potential as a more appropriate means of operation to face these challenges. In this paper, I present a brief review of three contemporary methods for urban analysis and planning, which move away from traditional practices and theories, namely: diagrammatic urbanism, scripted urbanism, and virtual urbanism. Additionally, I reflect on how digital tools are actively used in these processes, yielding more responsive interventions in tune with the current conditions of the city.

Flows and Diagrams

"What matters is not agriculture *per se*, but the great increase in the flow of matter-energy through society, as well as the transformations in urban form that this intense flow makes possible" (De Landa, 1997, 28). In 1999, the International Foundation for the Canadian Centre for Architecture (IFCCA), headquartered in Montreal, organized a major urban design competition that challenged participants to devise new ways of thinking about cities and their future. The brief asked for proposals for the planning of Hudson Yards, an underutilized area located on the west side of Manhattan characterized

by the presence of heavy transportation infrastructure (Muschamp, 1999). Among the five teams invited to submit designs, was the Amsterdam-based firm UN Studio, led by Ben van Berkel and Caroline Bos. For them, the IFCCA competition was an opportunity to continue testing proposals "to move away from the traditional interpretation of the urban planning process as a shifting around of volumes and to adopt a new approach based on new techniques and a new cooperative work strategy" (van Berkel & Bos, 2000, 46).

The origins of this alternative approach to urban design can be traced back to a master plan for the design of a 160,000 m2 transportation-oriented development in the city of Arnhem, in the Netherlands. For that project, UN Studio had expressed the need to respond in creative ways to the challenges and opportunities posed by issues of interconnectivity, communication, and flows in postindustrial global urbanization. The solution was a process they referred to as "deep planning".

Deep planning is a method which relies primarily on animation techniques to produce 3D analytical graphs of movements, activities and frequencies of use in the urban field. The process tracks flow through time, allowing a team of designers to visualize areas of overlap between programs, to examine interrelations across multiple categories, and to access information originating from diverse sources. This offers a comprehensive visual reading of the configuration and behavior of the city through a specific period of time. To actualize the data and translate it into architectural components, UN Studio employees used "operational diagrams", devices which are capable of encapsulating the performance of a site to evoke explicit spatial and structural organizations (van Berkel & Bos, 1998, 22). In the case of the master plan for the center of Arnhem, for example, UN Studio utilized the Klein bottle diagram (Fig. 1) as a referent to investigate opportunities in the spatial arrangement of the station area, expressing the fluidity of the continuous circulation trajectories on the site, while identifying connections between movement and other programmatic elements of the project.

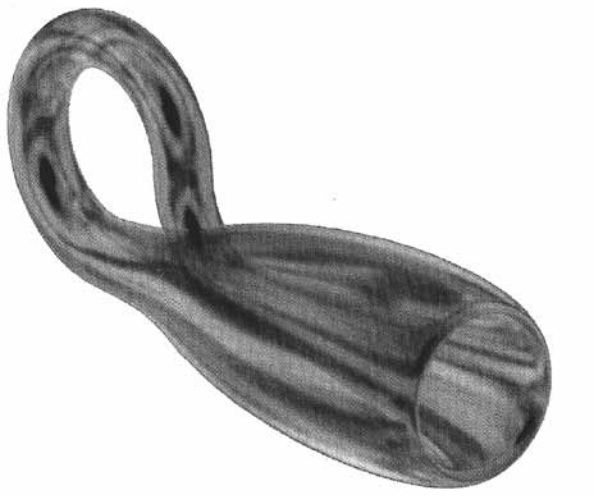

Figure 1. Klein bottle diagram by UN Studio

Arguably, one of the most advantageous characteristics of the use of deep planning over more traditional planning methods to address the current urban complexity, is the incorporation of the notion of time as an element of consideration in the generation of design proposals, allowing for a dynamic analysis of movement in connection to the territorial performance of an area in the city. Moreover, with advanced modeling and animation software packages designers can observe and study the fluidity of these phenomena instead of perceiving them in a frozen state; this enables them to scan areas of potential interaction, which can be integrated later into diagrams and spatialized into innovative urban interventions. Computation, as a time-based relational generator, becomes an essential tool to make this achievable.

Scripted Territories

"The catalogue of forms is endless: until every shape has found its city, new cities will continue to be born. When the forms exhaust their variety and come apart, the end of cities begins" (Calvino, 1974, 139). Design endeavors based on scripting, which use computer coding as the cornerstone of the process, require designers to formulate all architectural and urban elements in a project as parametrically programmable entities. The code translates the behavior of particular systems into geometric forms by defining distinct relations and rules of operation, or protocols. Despite the fact that a number of scripting languages have been available to designers for quite some time now—including C++, RhinoScript, and MEL, to name a few—it is fair to say that only until recently, with the release of the Grasshopper plug-in around 2007, these techniques became pervasive and accessible by a wider group of practitioners. Grasshopper is an affordable graphical scripting editor, developed to work within Rhino's 3D environment to provide an intuitive platform to explore parametric design while eliminating the need for learning any scripting language (Day, 2009, 14).

In the last decade the Architectural Association in London, more specifically its Design Research Lab (DRL) program, has pioneered a series of research studies on the dynamic character of cities, and on how architects can retool and operate to articulate this complexity using a variety of methods, including scripting. The research has been conducted simultaneously through a series of explorations carried out by a handful of architecture offices; however, perhaps the urban design projects developed at Zaha Hadid Architects (ZHA) are those that better illustrate this new approach (Fig. 2). Patrick Schumacher, partner at ZHA and co-director of the DRL at the Architectural Association, has been one of the strongest supporters of a shift towards a more script-oriented practice of urban design and architecture, arguing for "parametricism" as a new style in architecture (Schumacher, 2010, 266).

In 2006, ZHA won a competition for the Kartal Pendik master plan, a new city center on the east bank of Istanbul. The 555

hectare site, characterized by the presence of heavy transportation infrastructure and dilapidated industrial buildings, needed to be reactivated by the introduction of new urban elements, which included a central business district, residential developments, and cultural facilities. In order to tie Kartal Pendik back to the surrounding context, the project relies on scripts to create the conditions necessary for the emergence of a flexible set of urban typologies that gradually articulate the new soft fabric of the city with the requirements and complexity of each individual district. The transition between the old part of the city and the new development is achieved through a network of interconnected public spaces and the progressive densification of volumes, both parametrically fine tuned by scripted definitions (Fig. 3).

At the scale of the city, scripting is enabling designers to calibrate the way in which these relations inform urban space, using geometric grammar as the tool to introduce significant differentiation. Through the simultaneous production of a diversified population of buildings, morphological repetition can be avoided, permitting the architecture to be affected by the variation of contextual conditions. It could be argued then that, to a certain extent, the script functions in this case as an abstract diagram, disembodied from any literal representation of a specific shape or form, but capable of outputting a series of more responsive spatial arrangements and meaningful typological transformations (Fig. 4).

The City on the Cloud: Virtualizing the Urban Experience

"Each familiar species of public space had its actors, costumes, and scripts. But the worldwide computer network—the electronic agora—subverts, displaces, and radically redefines our notions of gathering places, community, and urban life" (Mitchell, 1995, 8).

During a press conference in Bengaluru, India, in early 2009, Cisco Systems unveiled its "Intelligent Urbanization Global Blueprint", a program that is part of its "Smart+Connected Communities" initiative. John Chambers, Cisco's Chairman and CEO, announced that "in a world where all things are becoming connected, the network has become the next utility, enabling holistic, intelligent and environmentally sustainable creation and management of cities, industries and public services" (Cisco Systems, 2009).

Cisco is not the only technology company who is considering the business of urbanization as one of the largest market niches over the next years. IBM, with its Smart Cities program (IBM, 2010), Hewlett Packard, with City 2.0, and others, are identifying an opportunity to use their portfolios of products and technologies to create formulas for an array of systematic problems affecting contemporary cities, from public safety to transportation, buildings, energy, healthcare and education.

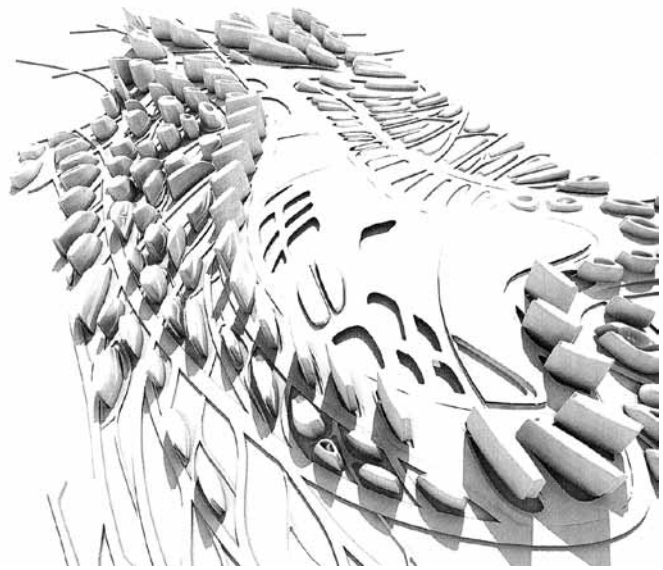

Figure 2. Master plan competition for Appur by Zaha Hadid Architects

Figure 3. Master plan for Kartal Pendik by Zaha Hadid Architects

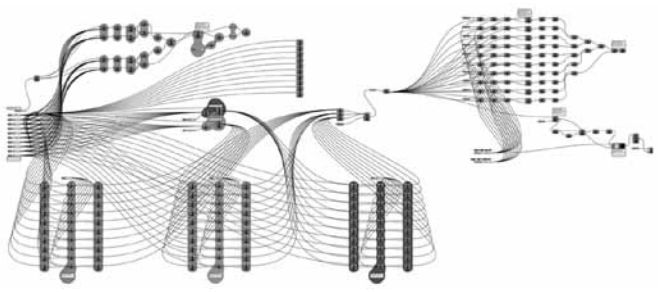

Figure 4. Grasshopper script

The breadth of the solutions is not limited to addressing the problems of existing cities. Cisco, for example, is participating in the creation of New Songdo, in Korea, one of the new planned instant-cities currently under construction in Asia. Proponents envision this 300,000 person community as a sustainable city completely wired with Cisco's digital infrastructure. All utilities and services are planned to be linked and monitored in real-time through multiple sensors controlled by a main operating system that, in theory, will increased efficiency in the management of the city's resources. In addition, all homes, offices, and other types of real estate, will be furnished with, among other things, points of access to Cisco's TelePresence videoconference systems in order to offer permanent connectivity—the possibility of attending meetings, classes, appointments, and cultural performances by virtualizing these activities.

There has been very little debate about the consequences that initiatives like New Songdo will have in the way people experience living in the new instant-cities. However, it is interesting to highlight that the primarily concern in this approach is not the production of a new form or type of urban space, at least not directly, and not in the conventional sense of the word. Nevertheless, when compared with the first two strategies reviewed in this paper, it is provoking to speculate about the impact that the virtualization of urban experiences will have in the redefinition of traditional public space, and the social and cultural behavior of cities.

Conclusion

In this paper I have reflected on the importance of investigating more appropriate processes to interrogate the challenges posed by the growing complexity of contemporary metropolises. Additionally, I have attempted to demonstrate the significant role digital technologies and computation have had in the development of new strategies for shaping cities, revealing how these methods are yielding a new kind of urban sensibility and coherence. Just as advanced fabrication technologies have recently provided designers with a more direct way of connecting with the materiality and constructability of architecture, perhaps in the case of the urban interventions computation is today providing us with the mechanisms necessary to reach a deeper understanding of the behavior of our cities, and of what ultimately constitutes their urban "matter".

References

Calvino, I. (1974). *Invisible cities*. Orlando: Harcourt, Inc.

Cisco Systems. (2009, February 12). *Cisco unveils "Intelligent Urbanisation" global blueprint* [Press Release]. Retrieved August 24, 2010, from: http://newsroom.cisco.com/dlls/2009/prod_021209e.html.

Day, M. (2009, May). Rhino Grasshopper. *AEC magazine*, 42, 14-15.

De Landa, M. (1997). *A thousand years of nonlinear history*. New York: Zone Books.

IBM Corporation (2010). *Smarter cities for smarter growth: how cities can optimize their systems for the talent-based economy*. Retrieved from: http://www-935.ibm.com/services/us/gbs/bus/html/smarter-cities.html.

Kwinter, S. (2001). *Architectures of time: toward a theory of the event in modernist culture*. Cambridge: The MIT Press.

Mitchell, W. (1995). *City of bits: space, place, and the infobahn*. Cambridge: The MIT Press.

Muschamp, H. (1999, October 18). Design strategies for a strip of the west side. *The New York Times, 1, 7*.

Schumacher, P. (2010). Parametric Diagrams. In M. Garcia (Ed.), *The Diagrams of Architecture* (pp. 260-269). Chichester: John Wiley & Sons.

United Nations (2008). *United Nations expert group meeting on population distribution, urbanization, internal migration and development*. New York. Retrieved from http://www.un.org/esa/population/meetings/EGM_PopDist/EGM_PopDist_Report.pdf.

van Berkel, B. & Bos, C. (1998, June). Interactive instruments in operation. *ANY Magazine*, 23, 19-23.

— (2000, June). Deep structure. *Architectural Design Magazine: Contemporary Processes in Architecture*, 70 (3), 44-55.