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Urban User Interface: Urban Legibility Reconsidered

Ginette Wessel, Elizabeth Unruh,
Remco Chang, Eric Sauda
University of North Carolina Charlotte

“(Social) space is a (social) product [...] the space thus produced also serves as a tool of thought and of action.” Henri LeLefebvre

It is plausible to consider the city using two distinct lenses, gazing alternatively at form and content. For a city, form is essentially spatial consisting of the disposition of objects across the landscape, both natural and manmade. Content concerns the various sacred and profane activities of the city and is essentially semantic, conveying specific social, cultural and economic meanings. Traditionally, cities were concrete spatial manifestations of cosmic or civic order. Although this is clearest in ideal cities like Sforzinda, it is also easy to read in almost every pre-modern city (Figure 1). The wall was a break between the known and the unknown, the tallest building was the temple, and the largest space was the palace. In all these cases, the semantic and the spatial were united in a clear and stable duality.

With the emergence of the modern city, space and semantic meaning have been loosened. There is no longer a wall, but a gradual fading out of the limits of the city. The tallest building only temporarily represents the seemingly most successful enterprise. Gridded city plans, long present particularly in military cities, are now endlessly extended in spatially undifferentiated ways.

The contemporary city has accelerated this trend (Figure 2). Not only is the content of space unmoored from a fixed location, but identification with space in the city is constantly updated by our interaction with mobile computing devices as they locate

everything from restaurants of interest to our friends' location to the latest flash mob. Semantic and spatial meanings shift and overlap at different times and for different groups.

Digital Urbanism

There has also been a tremendous increase in the amount of both spatial and semantic data about cities. Most cities in developed countries have accurate spatial information that includes multiple layers (building footprint information, satellite imaging, LIDAR information, topography, utilities, highways, etc.) at very high levels of accuracy and calibration. Semantic information is carried in dimension after dimension (ethnicity, income, building use, zoning, business name, age, tax value, etc) within systems such as GIS (Geographical Information System).

The result of these trends makes it difficult to recognize a city. If for Kevin Lynch urban legibility was largely a matter of spatial data (edge, path, node, landmark, district), for the contemporary city, it will need to include both spatial and semantic information.²

Despite the advent of online mapping services such as Google Maps and Microsoft Virtual Earth, current maps are much more effective at communicating the physical aspects of a city (such as street layout and parks) without telling us much about the functional and experiential characteristics (i.e., the semantic aspects of the city). Semantic information is difficult to locate (where are the clusters of restaurants?), name



1. Ideal plan of the city of Sforzinda, Filarete, 1464. Revista de Urbanismo, <http://revista.urbanismo.uchile.cl/n5/munizagatotal.html>, Accessed 13 August 2009.



2. Guwashi999, "Shibuya Night (HDR)," <http://www.flickr.com/photos/guwashi999/2491680523/>, Accessed 13 August 2009.

(are neighborhood names idiosyncratic to the city and how can we translate clusters into natural language?) and place (how does one mark a cluster of activity without an artificial and perhaps meaningless boundary?). In many ways, a map hand-drawn by a long-time resident is more informative than anything we can access online. These hand-drawn maps often include semantic information such as safe neighborhoods, shopping and business districts, and physical landmarks. Together, such generalized semantic information makes it easier to “understand” a city than using traditional city maps, and semantic maps seem better suited to deal with the demands for information that drive urban communication infrastructures.

In other words, the legibility of the city is no longer clear. Where does a city begin and where does it end? What are the important elements by which one understands and navigates the city?

Our interdisciplinary Urban Visualization Group (composed of researchers from architecture, urban design, geography, computer science and cognitive science) studies the impact of these questions on both complex urban analysis and the legibility of elements within cities.

We have mined geospatial studies (the where) sourced mainly from geography, which has an obvious interest in precise topographic description. Our research on semantic studies (the what) focuses on work by cognitive scientists interested in the structure of information, usually in tree or semi-lattice form. While there is general recognition these different forms of knowledge coexist, surprisingly little work has been done regarding their integration (mostly centered around the idea of errors induced by semantic categories). Both forms of information are often displayed together although a clear idea has not yet been presented about how to make this superimposition meaningful.

Our work on the computer program Legible Cities incorporates multiple windows that simultaneously visualize a large-scale urban model of 340,000 buildings and a set of census data on heat maps, in parallel coordinate and matrix panel views.³ This interface has been tested on urban designers and educational and governmental planners, and has been found to effectively coordinate geospatial and semantic information to create insights and possible meanings otherwise difficult to recognize in current programs.

Our study of comparative spatial and semantic recall of GPS and map users (Flying Blind) indicates that semantic information is most effectively organized within a spatial framework.⁴ This work points to the fact that semantic information is not independent of geospatial information, but rather that clusters of identifiable events group around spatial locations. The formal structure of the geospatial system is not pre-formed, but is dependent on the foci of the semantic data.

Our work emphasizes the procedural aspects of understanding, both because we know that computer-based information systems are likely to have a more and more prominent role as mediator of the urban environment, and because the need to carefully define this procedure forces a precise understanding of how the semantic and spatial data sets interact.

Our work, therefore, focuses on discovering algorithmic methods of extracting spatial clusters and meaning from a semantic database. We are currently experimenting with three possibilities:

1. Location quotient analysis is a method of discovering over or under-representation of functions within a city, often used for retail store decisions. Adoption of this method can be used for a wide range of other factors, from income to building use to health care deficiencies. There are potential problems, however, with identifying the scale of the area estimations.
2. Kernel estimation solves many of these problems by defining the influence of each data point in the city without the assumption of a size gradient. This technique has been used in geographical information science to successfully deal with dispersed and non-parametric data. It can highlight areas of interest for any factor.
3. Information theory tests each piece of information for its unique content, and similarly compares all possible pairs of information for their relative information content. It deals not with raw data but with shifts in data as measured by their derivative function.

While the technical problems with each of these methods await resolution, all have in common the ability to identify semantically important locations within the city along specific dimensions, and the selection of one or more dimensions will cause these locations to change.

Urban User Interface

Thus, two outcomes of our work have been the recognition of the existence of variable “images” of the city depending on the importance of different semantic data and on one’s position within the city. This has inevitably led toward a view of the city not as a static construct, but as a dynamic environment. We believe the best way to

conceive this new city is as an Urban User Interface.

Human computer interfaces (HCI) are more than a metaphor for urbanism. In fact, HCI development over the last 50 years parallels the longer arc of the transformation of the city. Computer interfaces provide an abstraction that communicates between the outside environment and the electronic circuitry of the computer. As Paul Dourish has noted, interface design has evolved from electrical to symbolic to textural to graphical to (he hopes) embodied.⁵ Each step in this evolution has put the interface more and more into the world.

If the city is to become a very large-scale interface, two important aspects will emerge.

First, like all interfaces, interactivity will lie at the core of an urban user interface. Urban residents expect to be able to query their environment, whether it is to find a friend in the city, discover new restaurants, or identify underserved welfare clients. Computing on a desktop, however, is not the same as computing in a city. Navigating with a mouse is replaced with moving through the city, around the block. While this change is driven by the proliferation of mobile computing devices, it also transforms the character of the computing by focusing on the level of interface. Particular aspects of the city, as the tangible half of the interface (orientation, movement, distributed computing), imply the range of possibilities available for the software and the manipulation of data.

Second, the interface will be tailored to differential user input, ranging from one's location in the city to the interests of the particular user. This does not imply complete subjectivity, but rather a field of possible interpretations. The same city may be interpreted differently by a tourist, a Latino teenager, or a skateboarder.⁶ And Iain Borden's work on skateboarding brings us back to ideas of urbanism, particularly the work of Henri Lefebvre.

Lefebvre connects human activities at all levels to the perception and arrangement of space. Rather than a neutral container, he believes it is a concretization of the political, social and economic realms. Although Lefebvre's interest is focused on large-scale change, it is equally true for groups within the city; the homeless perceive a different city than does the mayor. The work of Walter Hood extends these ideas into urban design practice by identifying and designing for different user groups within urban settings.⁷

Urban Legibility Reconsidered

The announcement of ubiquitous computing has led some to speculate that the physical presence of the city has become irrelevant; after all, we can access information about anything from almost anywhere. But Dourish makes the opposite argument. "Embodiment is about engaged action rather than disembodied cognition; it is about the particular rather than the abstract, practice rather than theory, directness rather than disconnection."⁸

His call is to interface designers so they may rescue and resuscitate the field. But the obverse may be true about urban design. It may need to give up the idea that physical structure exists apart from the human activity coursing through it. It seems inevitable that this will happen anyway, and as it does, it will transform our understanding of design.

Urban designers will need to understand how physical space appears as it is digitally

transferred, either as moving or still images or as more abstract forms, and how its representation might work.

Urban designers will need to understand the activity within their building as surely as they know the space, and to develop networks that create connections both conceptually and digitally.⁹

Urban designers will need to deal with the changes that flow through a city over a day, week, year or decade as deftly as they do with the manipulation of form.

Urban designers will need to develop tools of analysis and representation that take full advantage of time-based and generative media.

Urban designers will need to abandon seeing the city as paths, edges, district and landmarks and learn to see it as a fabric of flows, networks, scenes and graphs.

The static city is dead.

Endnotes

- 1 Henri Lefebvre, *The Production of Space* (Oxford: Blackwell, 1991), 59.
- 2 K. Lynch, *Image of the City* (Cambridge, MA: MIT Press, 1960). Lynch's work is still the most cited authority on urban legibility.
- 3 Remco Change, Ginette Wessel and Eric Sauda, "Legible Cities: Focus-Dependent Multi-Resolution Visualization of Urban Relationships," *Proceedings of the IEEE Transactions on Visualization and Computer Graphics*, 13 no. 6 (2007): 1169-1175. This work focused narrowly on an innovative visualization interface, but our broader goal was always focused on methods of combining semantic and spatial information in meaningful ways.
- 4 Ginette Wessel, Remco Chang and Eric Sauda, "Flying Blind: The Case for a Spatial Framework for Semantic Information," *ACM Transactions on Computer-Human Interaction* (in revision). This paper connects the recall of semantic and spatial information, finding a correlation which suggests space helps to organize the storage of semantic information.
- 5 Paul Dourish, *Where the Action is: The Foundation of Embodied Interaction* (Cambridge, MA: MIT Press, 2001).
- 6 Iain Borden, *Skateboarding, Space and the City* (Oxford: Berg Publishers, 2001). An interesting interpretation of LeFebvre concepts to "ordinary urbanism."
- 7 Clare Cooper Marcus, "Unexpected Company," *Landscape Architecture* <http://www.asla.org/lamag/lam03/june/feature1.html>, Accessed 13 August 2009. For example, Hood's design for Lafayette Square in Oakland identifies both the homeless and office workers as users, and designs a public space that is tuned to each group, woven together on the site.
- 8 Dourich, *Where the Action Is*, 189.
- 9 Rem Koolhaas, Stefano Boeri, Sanford Kwinter, Nadia Tazi, and Hans Ulrich Obrist, *Mutations: Harvard Project on the City* (Barcelona: ACTAR, 2000). Bernard Tschumi and R. Young, *The Manhattan Transcripts: Theoretical Projects* (London: Academy Editions, 1994). Rem Koolhaas and Bernard Tschumi have both engaged this idea, but no clear methodology has yet emerged that can be widely deployed.

Image Notes

1. Sideal plan of the city of Sforzinda, Filarete, 1464. *Revista de Urbanismo*, <http://revista.urbanismo.uchile.cl/n5/munizagatotal.html>, Accessed 13 August 2009.
2. Guwashi999, "Shibuya Night (HDR)," <http://www.flickr.com/photos/guwashi999/2491680523/>, Accessed 13 August 2009.