ABSTRACT

This paper discusses strategies of folding social media data with other geo-positioned information as a method of urban analysis. The complexities and contradictions of urban contexts have long served as engines for the abstract machine of architectural production, but these engines have been limited to formal qualities and not behavioral ones. The promise of social media is not just the production of geo-spatial information but connection of this information with the metadata of experience. Diagramming urban behavior serves to inform morphogenetic design processes as well as expand the agency of architecture.
INTRODUCTION

Earlier explorations into diagramming social media as a means of understanding urban behavior suggests both potentials and limitations to this approach (Webb 2014A & Webb 2014B). While geo-located social media provides an opportunity to track patterns of migration combined with metadata of experience, simple Web 2.0 sources are either too simplistic or produce too small a sample size to provide even simple provocations or superficial attempts at meaning. This paper investigates the combination of user-generated data with other big data sources and publicly available geo-located information.

THE DIAGRAM

As these explorations into mapping urban behavior develop, so do inherent questions of relevancy to the discipline of architecture. Biologists, Urban Designers, or Planners investigating patterns of urban behavior would produce a more direct linkage to their areas of expertise. Statisticians and Financial Analysts are more skilled in decrypting the big data associated with the migrations of millions of people on an annual basis. This paper contends the investigations of urban migrations and territories belong to discipline of architecture’s mastery of a single specific tool—the diagram.

Computational processes produce a clear relationship between force and form, producing what Sean Ahlquist and Achim Menges describe as formulating the specific. “Where computer-aided processes begin with the specific and end with the object, computational processes begin with the elemental processes and generative rules to end with information which derives form as a dynamic system.” (Ahlquist & Menges 2011) These processes synthesize rule-based responses to pressures and forces to find formal characteristics and organizations that both encode and respond to the pressures identified by the architect, enabling a framework for concretizing a formal condition.

If computational design is ultimately a synthetic diagram of pressures and forces, then not only are investigations into urban behavior relevant to the production of architecture but the action of describing the complexities of urban conditions are germane to architectural processes. In this sense, computational strategies have developed expertise in diagramming contextual complexities through the production of drawings, buildings, and other media. So it follows that the diagramming of urban behavior is the domain of the architect, and this domain not only serves the production of architecture but also expands the potential territory of architecture’s agency.

THE FOLD

The practice of architecture has developed a multitude of methodologies for describing complex urban forces within a built construct. Rather than describe them comprehensively, this paper intends to investigate the potentials of a specific technique—the fold.

Though initial descriptions of the fold can be traced back to deconstructivist philosophy, the fold in this context will be understood through Greg Lynn’s architectural appropriation. Lynn writes, “Where complexity and contradiction arose previously from inherent contextual conflicts, attempts are presently being made to fold specific locations, materials, and programs into architecture smoothly while maintaining their individual identity.” (Lynn 1998) Lynn uses the example of folding as a culinary technique, “where chocolate and an egg are blended together so that each is a distinct layer within a continuous mixture.”

The investigations presented in this paper leverage the disparate datasets to produce nascent strategies for understanding urban behavior. Geo-located cultural analytics are inherently complex and contradictory, and defy simple overlays to produce meaningful understandings. This paper proposes the folding of social media and other datasets into a continuous mixture of data, while maintaining each set’s individuality, to not only produce a legibility of urban behavior but also assert these analyses as architectural agents.

THE MAPPING

The process of mapping social media is an exercise in data synthesis and transformation. Geo-located points generated by social media platforms are positioned on geographic information, providing the urban context for the activity. The points are then translated into three-dimensional diagrams to illustrate aggregations, divisions, and tendencies. The strategy of folding resides in the determination of how different fields of geometry interact or how multiple data sets combine into a singular geometric field.

The parametric modeling tool Grasshopper is the engine for data synthesis. A plugin for Rhinoceros3D Grasshopper is a visual scripting interface with robust data management tools. A strong community of third-party developers has developed to create Grasshopper components, some of which search social media platforms for user-generated data.
While these inconsistencies can be modified through a text editor, this is a time consuming and inefficient process. As GIS data is often available directly through municipalities, the metadata is more frequently consistent and ordered. File size is an issue as well, but one of the opposing extreme to .osm data. Where .osm data is limited by download size and can only capture smaller cities in their entirety, the geographic reach of GIS shapefiles are large and difficult to manage. The Grasshopper plugin Meerkat not only facilitates GIS shapefile importation, but also trims multiple GIS shapefiles to limit the data to a selected region. Once the data is imported, GIS points are stitched by polylines to create a two-dimensional mapping of the target municipality. This information is then utilized as a background for positioning the social media information.

**BASE MAP**

Previous inquiries utilized the Elk component as the primary means of creating a mapping framework within the Grasshopper environment (Webb 2014A). While this efficiently produced facile mappings, there are two significant issues with this workflow. The first is the size limitation on downloads from Openstreetmap which prevents downloads of a city scale (Openstreetmap 2014). The other issue is relative to the consistency of categorization of the data itself. The nature of Openstreetmap as an open source of geographic data is that inconsistencies of metadata categorization exist. The objects in Openstreetmap, referred to as “ways”, are tagged with classifications such as “building”, “major road” or “waterway.” What one user may feel is a certain classification another user may construe as a different one. In the case of the .osm data for Venice, Italy there are no “major roads” or “minor roads”, all of the streets are classified as “pedestrian highways.” (Openstreetmap 2013A) While these inconsistencies can be modified through a text editor, this is a time consuming and inefficient process.

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IMPORTATION

The methods of information importation vary relative to the availability of Grasshopper components that target specific information sources. Grasshopper components that target a specific source will frequently allow for geo-positioning or keyword filtration within the Grasshopper environment, creating a specific inquiry relative to a location or topical interest. The Grasshopper component Mosquito allows for geo-positional searches of Twitter and Flickr, producing returns based off of a proximity to a geographic coordinate.

If a Grasshopper component is not available, filtration will occur either through a web interface such as Yelp! or Craigslist or through an Application Programming Interface (API) such as Instagram or Foursquare. These datasets are aggregated into spreadsheets, which are read by Grasshopper through the Grasshopper component LunchBox. The availability of a source-specific Grasshopper component will determine whether or not information filtration will be filtered internally to Grasshopper or externally (Webb 2014A).

TRANSLATION/POSITIONING

With a background mapping established and geo-located data imported, the geo-located information must be positioned relative to the map. The map has been positioned by Meerkat in Rhinoceros3D Cartesian space, but the user-generated data is located by geo-positioned coordinates. The Grasshopper component gHowl facilitates this translation between the two coordinate sets by referencing data points within Rhino-space to geo-located coordinates. The Grasshopper component Elk contains a SRTM module creates a framework between the two coordinate sets that gHowl can reference. The SRTM module uses NASA’s Shuttle Radar Topography Mission images to create scaled topographic points within Grasshopper. These points are referenced to geo-coordinates which provide the framework for the gHowl translation.

EXPORT/INTERFACE

Once diagrammatic geometry has been generated (see Diagraming Protocol), the geometry is exported as a javascript file to Leaflet (Figure 1). Leaflet is a JavaScript library for building web mapping applications (Wikipedia 2014). Leaflet is used to generate the mapping underlay for Openstreetmap, as well as Flickr, Craigslist and Foursquare (Openstreetmap 2013B). In this application, Leaflet provides a customizable interface with superior graphic capabilities to comparable platforms such as Google Maps and Google Earth.

DIAGRAMING PROTOCOL

Social Media information enters Grasshopper as point locations with attached metadata. While it is possible to import point data into Leaflet, aggregations of points do not achieve the same legibility as geometric constructs derived from point data. In addition to its strong data-management capabilities, Grasshopper’s robust graphic capabilities are utilized as well to fold data into productive hybrids.

FLICKR DATA/CRIME DATA

This study investigates the use of Flickr data folded with criminal reports in downtown Las Vegas. Flickr is one of the largest repositories of geo-located social media, and may be imported into the Grasshopper environment through the component Mosquito (Webb 2014A). Criminal reports are publicly available, and in this case are aggregated into a spreadsheet which is read by LunchBox. The addresses associated with the crimes are translated into geo-coordinates by Mosquito’s Location module.

A grid is imposed over Las Vegas, and each cell is tested for inclusion with a Flickr geo-location. If a Flickr-generated geo-point is contained by the cell, geometry is generated. The geometry is then scaled based off of the number of points included in the cell, and distorted based off of proximity to the geo-located criminal reports (Figure 2). In this case, two sets of disparate information are folded together to produce a cellular heterogeneity, a parallel existence between two sets of data.

TRIPPIN’IN/CRIME DATA

This study uses the platform Trippin’in to aggregate geo-located social data from Twitter, Instagram, Flickr and Foursquare data in Los Angeles. The geo-positioned data is combined with business data from Facebook, Yelp! and Trip Advisor. The Trippin’in API is queried for keywords related to basic urban behaviors- “eat”, “drink”, “shop” and “party.” The resulting geo-locations are mapped against the city, and the data folded with criminal report data as well.

A grid is imposed on Los Angeles, and the geo-located social media and criminal reports are aggregated (Figure 3). The keyword metadata of the activities drive the color of the grid and the relative crime rates drive the thickness of the grid cells. The data-sets remain heterogeneous, yet composited within one data field.
CONCLUSION

The folding of social media with other datasets such as crime reports, real estate data, census data and other geo-positioned information could be potentially helpful in understanding urban behavior. As geo-positioned information becomes more ubiquitous, these methodologies could escape the criticisms of sample size, demographics, and statistical accuracy that social media poses.

LIMITATIONS

There are significant limitations to the accuracy of available geo-positioning tools. *gHow* treats the geographic coordinate system as a Cartesian coordinate system, which it is not. The geographic coordinate system is based on a spherical grid, so an accurate translation between the two is a complex calculation that is neither currently supported nor addressed by the project team. For the purposes of these proof of concept studies, this inaccuracy is manageable but is a deficiency that will be addressed. Issues around user privacy are a significant consideration for this line of inquiry. Though all of the data used in these studies are publicly available, it is likely that the users themselves are not intending to be tracked or monitored. To pursue these investigations on a larger scale, these ethical considerations must be addressed in a serious manner.

FUTURE WORK

The utilization of architectural strategies towards addressing complex urban conditions in diagrammatic media is a germane skill set to the discipline. To implement these strategies informs architectural production and extends architecture’s agency.
As diagrammatic understandings of urban behavior become actionable, questions of how built form can respond to these forces will arise. Unlike other morphogenetic engines such as passive solar heating/cooling or rainwater harvesting, the linkage from force to form is less direct and clear. Further inquiries will investigate this relationship, determining how complex datasets can fold into form.

REFERENCES


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IMAGE CREDITS

Figure 1-2. Image credits to Alexander Webb (2014).

Figure 3. Sabogal, Carlos; Qurashi, Alaa (2014) Social Data and Criminal Activity in Los Angeles.

ALEXANDER WEBB has been primarily interested in how emergent organizational systems can be deployed and mis-used for functional purposes. Using parametric and animation design software, Alex looks to evolutionary intelligence and mathematic models as the generator of architectural concepts. Using programming languages as an integral part of his design process, Alex works to codify environmental data and integrate it into architectural systems to create high-performance constructs.

Alex established his own design practice and consultancy firm in 2010, and has worked for firms such as (M)Arch., Marmol + Radziner, Patterns, Coop Himmelb(l)au, Xefirotarch, Jones Partners Architects, Griffin Enright, and Gensler. Alex holds a Masters of Architecture from the Southern California Institute of Architecture, a Bachelors of Fine Arts from Colorado College, and has also studied architecture and design at the Berlage Institute and Columbia University.