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Invisible Cities: Representing Social Networks in an Urban Context

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ABSTRACT Cities are comprised of complex social networks. In addition to the physical architecture these networks define our experience of the urban environment. *Invisible Cities*, a project named after the novel by Italo Calvino, aims to provide insight into the composition of urban social networks by surfacing data from online services, geographically mapped, in order to identify the areas of high and low activity. The visualization thus reveals emerging social themes.

Invisible Cities is a multivariate data visualization presented as a three-dimensional spatial environment. It displays individual Twitter status updates and Flickr photos on a geo-registered surface reflecting aggregate activity over time. As data records are accrued, the surface transforms into hills and valleys representing areas with high and low densities of data. Data points are connected in chronological order by paths representing themes extracted from status updates and image metadata.

The project's three-dimensional representation enables the simultaneous macro- and micro-reading of information through its perspectival compression within the field of view. The foreground displays detailed information at a local level, while the surrounding context offers the comparison with other data. The outcome is an immersive space the viewer can explore, creating immediate parallels that may respond to or contradict the physical architecture of the city. It also allows for the real-time analysis of overlapping themes present within localized social networks.

DOCUMENTATION

Invisible Cities began with the objective to visualize the collective memory of a city. Our memories are often linked to places, and places become aggregators of memories. There is a recursive relationship between the impressions places make on us and the spaces we create or help define through our presence and actions. As such, a city can be considered the outcome of collective memory, the encapsulation of actions and experiences linked to places that shape and redefine the city itself.

The recursive relationship between thought and the built environment was a central factor for *Pastiche*, an earlier data visualization documented in Volume 2, Issue 1 of the *Parsons Journal for Information Mapping*. Aiming to identify the collective associations formed around city

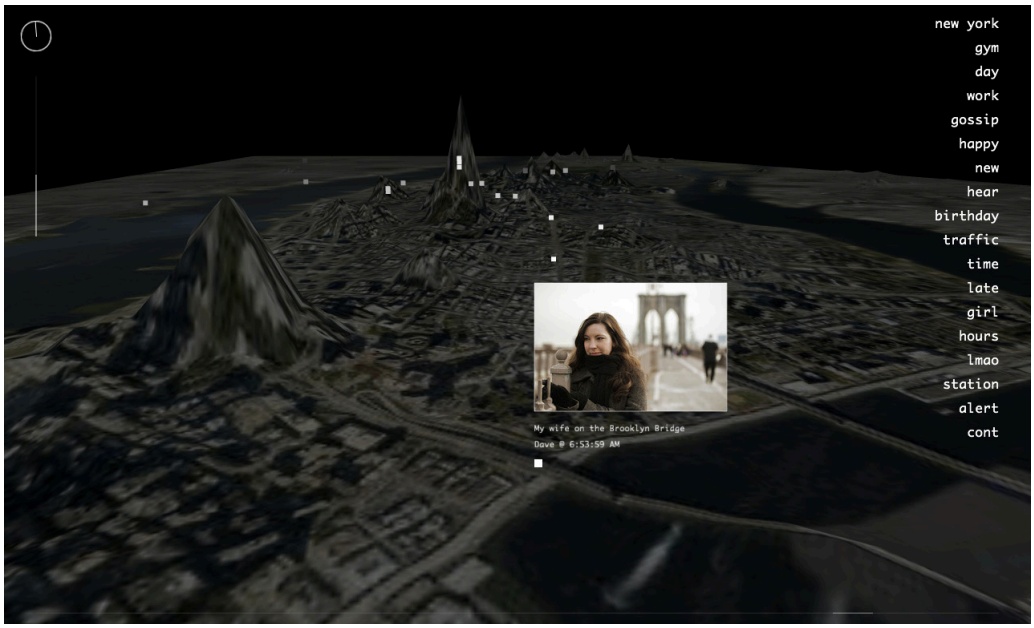

FIGURE 1: *A view of lower Manhattan with a photograph selected.*

FIGURE 2: *An aerial view of a topic path with the earliest record selected.*

neighborhoods, it offers an aggregate view of keywords derived from blog articles. The visualization is based on relevance with the most frequent keywords rising to the top and remaining linked to their respective neighborhoods—until being displaced by more relevant keywords.

Like *Pastiche*, *Invisible Cities* creates an immersive, three-dimensional space the viewer can experience from a first-person vantage point. Yet, unlike the former, time, not relevance, is the primary organizing principle. Furthermore, the visualization depicts not only individual keywords, but also the source data. This offers an information-rich, time-based narrative experience.

The *Invisible Cities* client application, in beta at the time of writing, was created in Processing (www.processing.org), an open-source programming language built on top of Java and founded by Ben Fry and Casey Reas while at the MIT Media Lab. Requiring an active connection to the Internet, the application parses data in real-time from the public Twitter and Flickr APIs (application programming interface), while interfacing with a custom-written Google web application for displaying archived Twitter status updates. Geocoded updates and photos are displayed on an extruded satellite basemap of New York, extracted using the Google Maps API. The entire development process has taken several months to-date, and apart from the larger vision for the project, much of the process has been iterative. While the implementation of a particular feature sometimes did not produce the expected outcome, it often suggested another, better solution. We evaluated solutions based on whether they would contribute to creating greater engagement with the content. For instance, we ended up limiting the scope of view to 24 hours, since this time period seemed more pertinent and effective for the type of information we were displaying.

Content is presented using three parallel time scales: current, aggregate, and timeline. Current data records are read and displayed in real-time, remaining in view for one hour, after which they are added to an archive aggregating 24 hours of data. This determines the relative elevation of the underlying terrain. A timeline allows the viewer to move back and forth within the overall 24-hour timeframe as the data, topics, and terrain change in parallel.

The connection between collective memory and geographic context is central to *Invisible Cities*. While geocoded data records are mapped to places, paths connecting individual records map places to topics. This reveals

a new kind of geography in which the urban landscape is reframed through narrative (a sequence of events in space and time). In this case, however, the story is told not by a single person, but by groups of individuals. By following a topic path, places are experienced in the proximity of other places, related to one another by shared thematic associations. This notion was the genesis of the visualization, initially inspired by Guy Debord's 1955 Psychogeographic guide of Paris. Debord cut up a map of Paris into places that people experienced as distinct "unities" and separated them according to the mentally felt distances between them. Building on this idea, the experience *Invisible Cities* attempts to create is one in which places are rearranged fluidly according to their thematic relatedness.

FIGURE 3:
A view of a topic path amid an extruded Manhattan basemap.

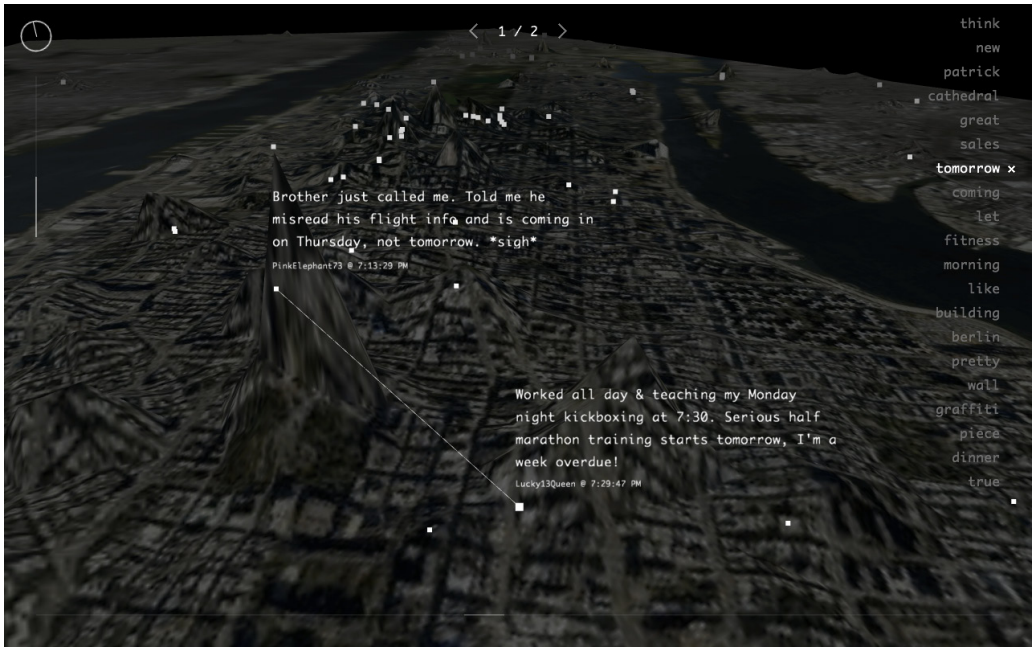

FIGURE 4:
An image demonstrating how data records are linked based on shared keywords.

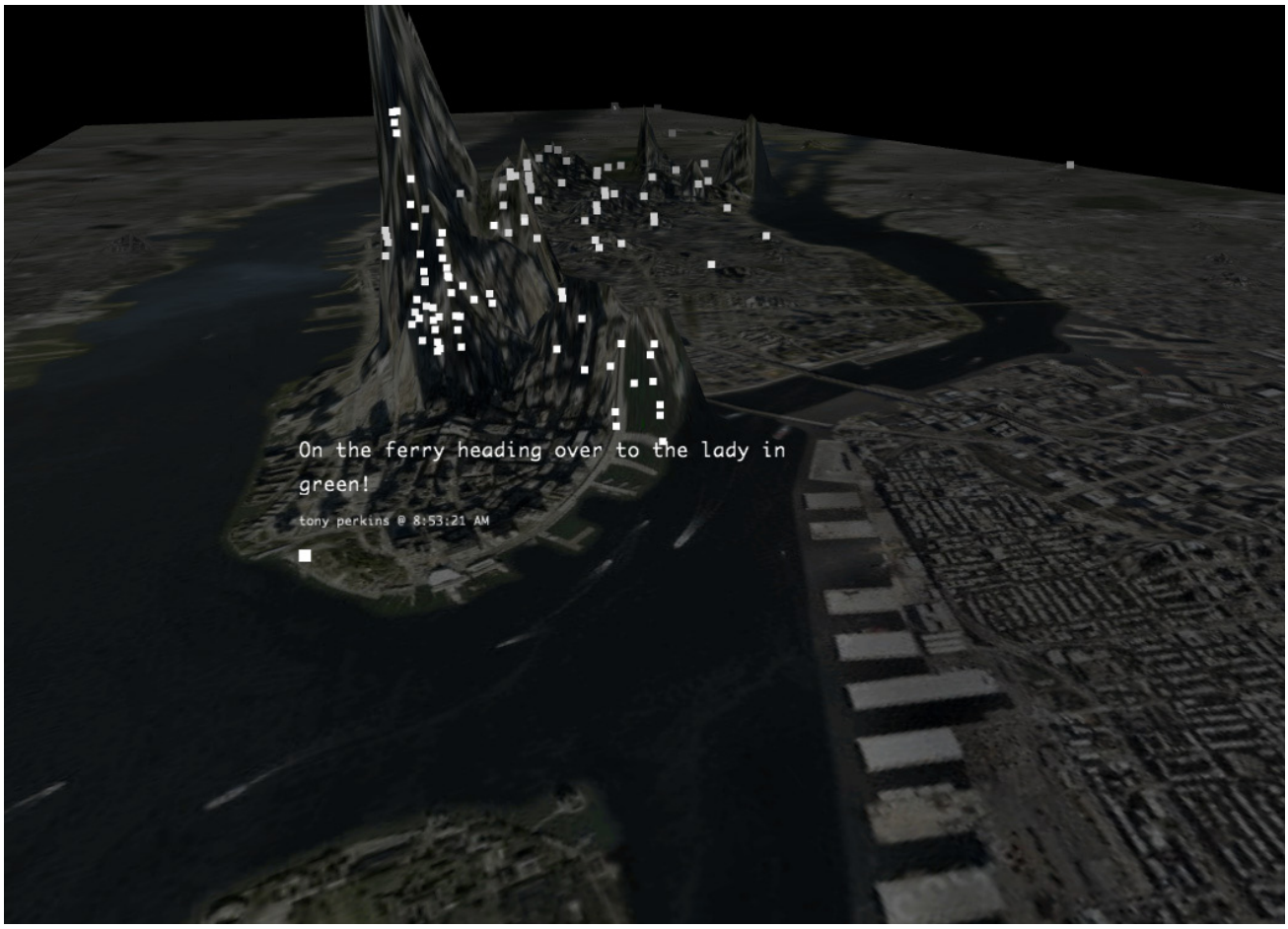

FIGURE 5: *A view of lower Manhattan with a Twitter update selected.*

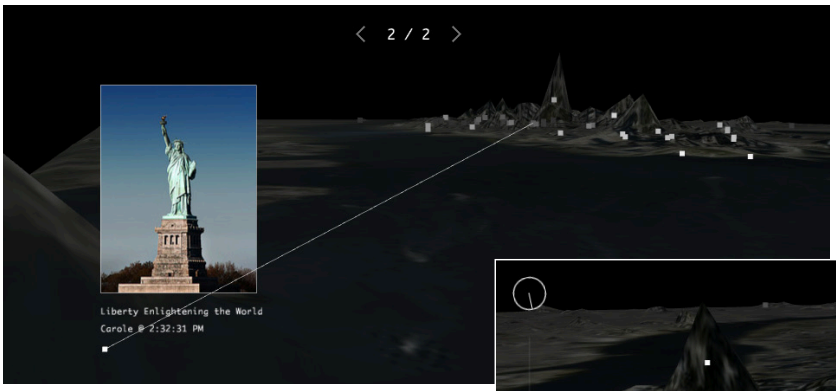

FIGURE 6:
A selected photo as part of a two-node topic path.

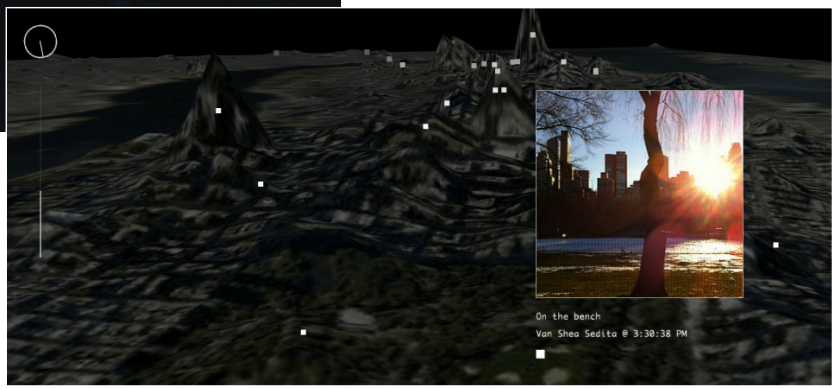

FIGURE 7:
A view of a photo taken in Central Park.

FIGURE 8: *Topics are listed to the right of the screen and change according to the selection from the timeline below.*

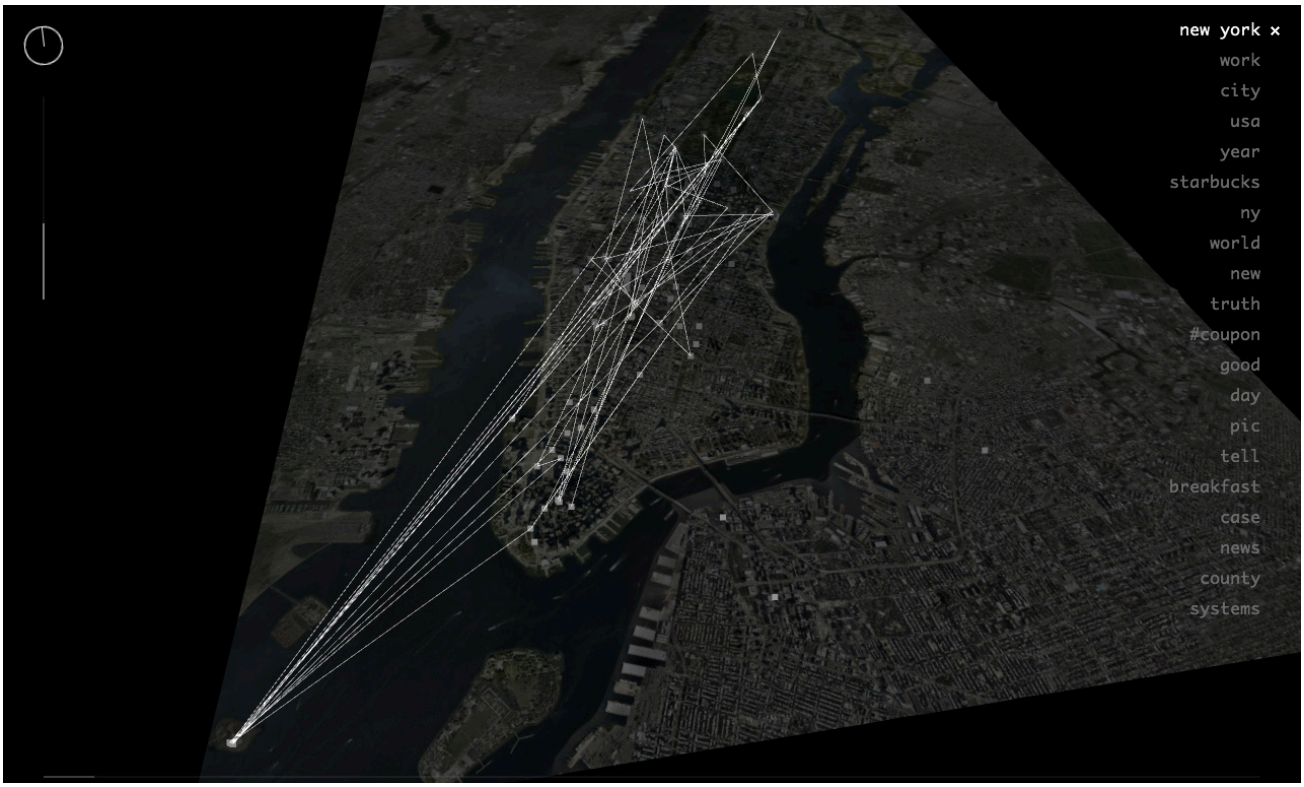

FIGURE 9: *An aerial view of a complex topic path is seen here.*

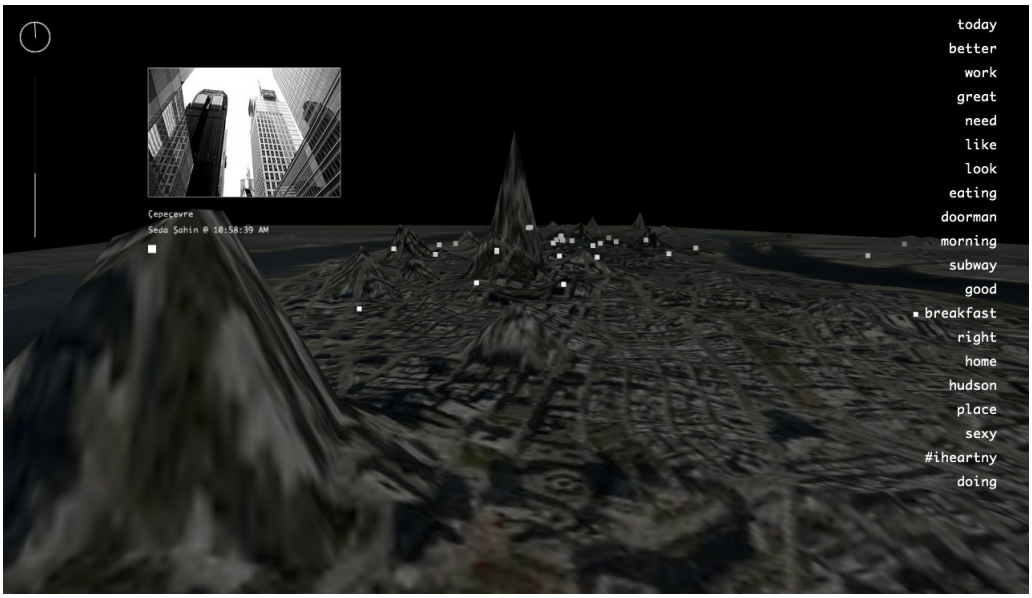

FIGURE 10:
Data records are aggregated over 24 hours to generate relative height of the landscape.

What differentiates this project from many other visualizations of social data is the immersive experience created by a three-dimensional, first-person view. Compared to a conventional two-dimensional representation, a first-person view has several important points of distinction.

First, it encourages continuous discovery. Detailed information at a local level is shown in the foreground, while the surrounding data enables contextual comparison. This so-called "focus + context" interaction model provides an effective method for browsing large datasets, giving the viewer the means to make selections incrementally from a focused set of geographically-related entities. *Invisible Cities* attempts to recreate a simultaneous macro- and micro-level experience: as we are accustomed to in the physical world.

Second, a first-person view creates a sense of presence by simulating aspects of our perception of the physical world. The perspectival view and extruded ground plane in *Invisible Cities* creates the sensation of being physically situated within a spatial environment, not merely as a spectator, but as a participant. A sense of presence, of "being there," encourages dialog with the system and establishes a visceral relationship to the represented space. As a visualization of collective memory, the latter is of particular significance to *Invisible Cities*, which aims to draw attention to the particularities of the places referenced by the data.

When exploring the emerging information landscape depicted in *Invisible Cities* one is able to perceive a variety of "sub-cities." Places, decontextualized as urban islands by the social activity they attract, are recontextualized by the trajectories created from emerging topics, similar to Debord's map of Paris. These trajectories are, in a sense, microcosms within the larger city context, of which there are an infinite number. These are the "invisible cities" after which we named the project. By representing networks as physical constructs in a simulated environment, *Invisible Cities* makes the claim that there is another, emerging form of architecture in the urban landscape that merit attention: the architecture of social networks.

BIOGRAPHIES

Christian Marc Schmidt is a German/American designer and media artist. From an interest in working with data he has adopted a parametric, process-oriented approach in his work, which is concerned with evidence, disclosure and the materiality of information. His work has received international recognition, including from the D&AD in London, the Society for Environmental Graphic Design, Communication Arts, and the IDSA, and he has taken part in exhibitions and screenings nationwide and overseas.

Liangjie Xia is a media artist and programmer presently based in New York City. His work explores alternative forms of communication through innovative applications of technology. His experiments vary from interactive, data-visualization mobile applications to physical installations. He loves and contributes to open source projects, and hacks with whatever is handy. Liangjie recently received Master of Professional Studies degree from the Interactive Telecommunications Program at NYU.