Visualizing Data for Transportation Analytics

Dr. Sara Diamond, OCAD University
The Virtual City: Data Rich, Data Producing

- An invisible grid made up of networks, packets and data
- Surveillance technologies, interactions, connected devices
- Mobile internet, applications and devices
- Energy and carbon consumption
- Transportation and movement
- Development and planning
- A city of open data as a base for applications
City as a Wealth of Data

- http://flowingcity.com/: Visualizing the City built of data, Urban Data Visualizations of the City, making the city smarter with data

- Data sources: Government records, corporate records, community-generated data, Cameras, car GPS, GPS, Census data, Location apps, Mobile apps, RFID, sensors, social media, Wi-Fi antenna, WWW, etc.
Urban Data Challenge
Open data “hackathon”
Merge and compare mobility data sets from three cities—San Francisco, Geneva, and Zurich—and draw meaningful insights.
Dots on the Bus, Adam Greenhall, Amelia Greenhall, Jared McFarland
Frustration Index, Srivinas Ashok, Daphne Dethier, Carmel Dudley, Steve Peppe
On Broadway, Manovich et al.
On Broadway
Data Canvas – Media Network to promote public awareness

- DIY sensor network to measure pollution, dust, light, sound, temperature, and humidity. Overall environmental quality but also relevant to transportation uses.
- Created an interactive map, opened the data, and asked participants to use it to narrate a story about their city.
sonic particles 2.0

A sonification of real-time urban environmental data
Sonic Particles

- [Link](http://datacanvas.org/project/sonic-particles-2-0/)
- Sonic Particles 2.0 is a real-time sonification
- Updated every 5 seconds.
- Each city can be differentiated.
Liu Bolin,
Hiding in the City
The Mobile City: A Fully Enabled Grid

- Mobility is about the individual, not the device.
- The urban experience of ubiquitous connectivity, personalized and context-aware services and content that link us to daily activities and interests, regardless of time and place.
- Continual discovery, enhancement
Designing the City at Night, Barcelona (social media, open data, light), I - Varis, Diez & Corbero
Designing the City, Tone of Social Media
http://www.atnight.ws/
Designing the City at Night, bike storage data
Designing the City at Night, Taxis
Taxis vs Density
Visible Amsterdam (movement of crowds), Euro Beinat
Walkable Streets Project

- ESRI is also involved in modeling walkable streets, for example as a project with the City of Halton
- Complete Streets
Walkable Streets Project

Central London Street Walkability
Smart & Beautiful rating

- Lots of trees
- Smart & Beautiful rating
- Not many trees

© Walkonomics
San Francisco

Smart and Beautiful rating
Street Walkability
San Francisco

© Walkonomics.com
San Francisco
iCity concept of city systems as nested structures

Figure 2: Hierarchical Approach to Urban Systems

Each system decomposes into sub-systems; E.g., “the” transportation system consists of:

- The road system
- Transit system
- Active transportation system
- Operating agencies

Each “system” interconnects & interacts with other systems

Cities (urban regions) are “systems of systems”.

(Mayer & Miller, 2015)
Modeling systems relationships

Figure 3: Spatial-Temporal Representation

- Systems of systems, long-run, strategic
- Sub-systems & systems, medium/long-run, tactical & strategic
- Components, short-run, operations
Betaville and Story Facets visualization tools

- Design Approach
  - Communication Centered
  - Collaboration-Minded
- Visual Data/Model Integration
  - Able to link qualitative data
  - Real-time “what-ifs”
  - Changing/historical data and data ontologies
  - Provenance
Betaville and StoryFacets

- **Visualization Techniques**
  - Interactive Computing
  - Overview + Detail
  - Geospatial Visualization
  - Info vis
  - Comparative Visualization

- **White Boxes**
  - Ontology
  - Models – transparency
  - Provenance - retrievability
Betaville
StoryFacets

Overview

(a) Trail Facet

(b) Dashboards or Info Graphics Facet

(c) Story Facet
StoryFacets

Story (slideshow) facet – Star Wars character height

Subtitle
Among the residents select who is tallest.

A Chart from Trail

Slides Preview
StoryFacets
Linked back to trail facet

(a) Trail Facet

(b) Dashboards or Info Graphics Facet

(c) Story Facet
GraphTrail
Provenance & chart parameterization

Municipality = Écija OR Marchena
Grouped by Ceramic Component
Home Location of Respondents

[Map showing the location of respondents with various symbols and colors representing different categories of students and proximity to subway/FT and GO Rail.]
StudentMove TO
<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of housing</td>
<td>24.1%</td>
</tr>
<tr>
<td>The decision was out of my control</td>
<td>20.7%</td>
</tr>
<tr>
<td>Ability to walk or bike to campus</td>
<td>15.9%</td>
</tr>
<tr>
<td>Housing qualities (space, yard, ...)</td>
<td>9.2%</td>
</tr>
<tr>
<td>Proximity to public transit</td>
<td>8.1%</td>
</tr>
<tr>
<td>Being near friends and family</td>
<td>7.4%</td>
</tr>
<tr>
<td>Amenities of neighbourhood (shops, parks, houses, ...)</td>
<td>6.3%</td>
</tr>
<tr>
<td>Other</td>
<td>4.4%</td>
</tr>
<tr>
<td>Walkability of neighbourhood</td>
<td>2.4%</td>
</tr>
<tr>
<td>Crime and safety</td>
<td>1.4%</td>
</tr>
</tbody>
</table>
Relationships commute time and school engagement

- Percentage coming to campus daily by distance of commute
- One way commute and involvement in school: pick courses by commute time, commute discourages coming to campus, commute discourages extracurricular activity
## Work/Drivers of Change

### PERCENTAGE WHO WORK

<table>
<thead>
<tr>
<th>Work Status</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not work</td>
<td>46%</td>
</tr>
<tr>
<td>Work part time (&lt;10 hours per week)</td>
<td>20%</td>
</tr>
<tr>
<td>Work part time (11-20 hours per week)</td>
<td>19%</td>
</tr>
<tr>
<td>Work part time (21-30 hours per week)</td>
<td>7%</td>
</tr>
<tr>
<td>Work 31-40 hours per week</td>
<td>4%</td>
</tr>
<tr>
<td>Work &gt; 40 hours per week</td>
<td>3%</td>
</tr>
<tr>
<td>Work part time (21-30 hours per week)</td>
<td>7%</td>
</tr>
<tr>
<td>Work 31-40 hours per week</td>
<td>4%</td>
</tr>
<tr>
<td>Work &gt; 40 hours per week</td>
<td>3%</td>
</tr>
</tbody>
</table>

### MODE CHANGE MOTIVATIONS

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in household location</td>
<td>59%</td>
</tr>
<tr>
<td>Improvements to transit</td>
<td>26%</td>
</tr>
<tr>
<td>Decreased transit costs</td>
<td>21%</td>
</tr>
<tr>
<td>Increased transit costs</td>
<td>20%</td>
</tr>
<tr>
<td>Worse congestion</td>
<td>15%</td>
</tr>
<tr>
<td>Decreased parking costs</td>
<td>15%</td>
</tr>
<tr>
<td>Nothing, Will not change</td>
<td>14%</td>
</tr>
<tr>
<td>Improved bike lanes</td>
<td>9%</td>
</tr>
<tr>
<td>To improve health</td>
<td>7%</td>
</tr>
<tr>
<td>Environmental concerns</td>
<td>6%</td>
</tr>
<tr>
<td>Roadwork disruptions</td>
<td>6%</td>
</tr>
<tr>
<td>Improved pedestrian environment</td>
<td>4%</td>
</tr>
<tr>
<td>Increased parking costs</td>
<td>3%</td>
</tr>
<tr>
<td>Added bike storage</td>
<td>3%</td>
</tr>
</tbody>
</table>
Video Student MoveTO

- Betaville – where are students located and what is their destiny?
- StoryFacets – factors in considering a new home...